Prof. Eduard R. Kobert M.
with the kind regards
of Joseph P. Remington
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THE

PRACTICE OF PHARMACY.

A TREATISE

ON THE MODES OF MAKING AND DISPENSING OFFICIAL, UNOFFICIAL, AND EXTEMPORANEOUS PREPARATIONS, WITH DESCRIPTIONS OF THEIR PROPERTIES, USES, AND DOSES.

INTENDED AS A

HAND-BOOK FOR PHARMACISTS AND PHYSICIANS

AND A

TEXT-BOOK FOR STUDENTS.

THIRD EDITION.

ENLARGED AND THOROUGHLY REVISED.

BY

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WITH OVER SIX HUNDRED ILLUSTRATIONS.

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PREFACE TO THE THIRD EDITION.

THE publication of the United States Pharmacopœia (seventh decennial revision) in 1893 furnishes the *raison d'être* for a new edition of the "Practice of Pharmacy," the sweeping changes which have been made in the Pharmacopœia, and notably the acceptance of the Metric system of weights and measures, having caused a revolution in pharmaceutical practice.

The addition of many new remedies and the alterations in chemical and botanical nomenclature in the Pharmacopœia have added greatly to the labor of preparing the manuscript of the present work; and, since it aims to present those facts which shall be of the greatest usefulness to the pharmacist and student in such a manner as to command attention, without being so brief as to fail in its mission, an increase in the size of the book was inevitable.

The features in the former edition which seemed to give greatest satisfaction to its readers have been retained; and among the new ones may be mentioned the "Glossary" at the end of the formulary, containing short definitions of uncommon terms which the pharmacist is liable to be suddenly called upon to interpret.

The working formulas are constructed with especial regard to the avoidance of errors in their use, the proportions of the various ingredients being arranged to suit the needs of every-day workers who use the "Practice of Pharmacy" as a hand-book.

The index, which has been amplified, has been prepared by Alfred B. Taylor, A.M., a comprehensive table of metric and old form

equivalents has been added, and the feature of indicating working formulas by heavy-faced type has been retained.

In conclusion, the author desires to express his thanks to his many professional friends for the words of encouragement with which they have favored him; while to the pharmaceutical students, who mainly use the work as their guide, he trusts that the third edition will prove as welcome as its predecessor, and be a valuable aid in leading them to success and prosperity.

J. P. R.

PHILADELPHIA, August, 1894.

PREFACE TO THE FIRST EDITION.

THE rapid and substantial progress made in Pharmacy within the last decade has created a necessity for a work treating of the improved apparatus, the revised processes, and the recently introduced preparations of the age.

The vast advances made in theoretical and applied chemistry and physics have had much to do with the development of pharmaceutical science, and these have been reflected in all the revised editions of the Pharmacopœias which have been recently published. When the author was elected in 1874 to the chair of Theory and Practice of Pharmacy in the Philadelphia College of Pharmacy, the outlines of study which had been so carefully prepared for the classes by his eminent predecessors, Professor William Procter, Jr., and Professor Edward Parrish, were found to be not strictly in accord, either in their arrangement of the subjects or in their method of treatment. Desiring to preserve the distinctive characteristics of each, an effort was at once made to frame a system which should embody their valuable features, embrace new subjects, and still retain that harmony of plan and proper sequence which are absolutely essential to the success of any system.

The strictly alphabetical classification of subjects which is now universally adopted by Pharmacopœias and Dispensatories, although admirable in works of reference, presents an effectual stumbling-block to the acquisition of pharmaceutical knowledge through systematic study: the vast accumulation of facts collected under each head being arranged lexically, they necessarily have no connection with one another, and thus the saving of labor effected by considering similar groups together, and the value of the association of kindred subjects, are lost to the student. In the method of grouping the subjects which is herein adopted, the constant aim has been to arrange the latter in such a manner that the reader shall be gradually led from the consideration of elementary subjects to those which involve more advanced knowledge, whilst the groups themselves are so placed as to follow one another in a natural sequence.

The work is divided into six parts. Part I. is devoted to detailed descriptions of apparatus and definitions and comments on general pharmaceutical processes.

The Officinal Preparations alone are considered in Part II. Due weight and prominence are thus given to the Pharmacopœia, the National authority, which is now so thoroughly recognized.

In order to suit the convenience of pharmacists who prefer to *weigh solids* and *measure liquids*, the officinal formulas are expressed, in addition to parts by weight, in *avoirdupois weight* and *apothecaries' measure.* These equivalents are printed in *bold type*, near the margin, and arranged so as to fit them for quick and accurate reference.

Part III. treats of Inorganic Chemical Substances. Precedence is of course given to officinal preparations in these. The descriptions, solubilities, and tests for identity and impurities of each substance are systematically tabulated under its proper title. It is confidently believed that by this method of arrangement the valuable descriptive features of the Pharmacopœia will be more prominently developed, ready reference facilitated, and close study of the details rendered easy. Each chemical operation is accompanied by equations, whilst the reaction is, in addition, explained in words.

The Carbon Compounds, or Organic Chemical Substances, are considered in Part IV. These are naturally grouped according to the physical and medical properties of their principal constituents, beginning with simple bodies like cellulin, gum, etc., and progressing to the most highly organized alkaloids, etc.

Part V. is devoted to Extemporaneous Pharmacy. Care has been taken to treat of the practice which would be best adapted for the needs of the many pharmacists who conduct operations upon a moderate scale, rather than for those of the few who manage very large establishments. In this, as well as in other parts of the work, operations are illustrated which are conducted by manufacturing pharmacists.

Part VI. contains a Formulary of Pharmaceutical Preparations which have not been recognized by the Pharmacopœia. The recipes selected are chiefly those which have been heretofore rather difficult of access to most pharmacists, yet such as are likely to be in request. Many private formulas are embraced in the collection; and such of the preparations of the old Pharmacopœias as have not been included in the new edition, but are still in use, have been inserted.

In conclusion, the author ventures to express the hope that the work will prove an efficient help to the pharmaceutical student as well as to the pharmacist and the physician. Although the labor has been mainly performed amidst the harassing cares of active professional duties, and perfection is known to be unattainable, no pains has been spared to discover and correct errors and omissions in the text. The author's warmest acknowledgments are tendered to Mr. A. B. Taylor, Mr. Joseph McCreery, and Mr. George M. Smith for their valuable assistance in revising the proof-sheets, and to the latter especially for his work on the index. The outline illustrations, by Mr. John Collins, were drawn either from the actual objects or from photographs taken by the author.

PHILADELPHIA, October, 1885.

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PRACTICE OF PHARMACY.

INTRODUCTORY.

THEORETICAL AND PRACTICAL PHARMACY.

Pharmacy is the science which treats of medicinal substances. It comprehends not only a knowledge of medicines and the arts of preparing and dispensing them, but also their identification, selection, preservation, combination, and analysis.

The word Pharmacy is also used to designate the place where medicines are sold.

For convenience in study, Pharmacy may be divided into two great classes,—viz., *Theoretical Pharmacy* and *Practical Pharmacy*.

Theoretical Pharmacy.—Inasmuch as all Nature, animate and inanimate, has been laid under contribution to provide remedies for the alleviation of disease, it follows that those sciences which embrace a knowledge of substances obtained from the vegetable, mineral, and animal kingdoms, as well as those which treat of the laws governing them, are called upon to furnish important facts which form the basis of the science of Pharmacy.

Botany, the science of plants, *Mineralogy*, that of inorganic substances found in or on the earth, and *Zoology*, the science which treats of animals, are, however, less important than *Chemistry* and *Physics;* for upon these two Pharmacy is most dependent for its greatest development and its highest degree of usefulness.

Physics or *Natural Philosophy* is that branch of science which describes and explains the changes produced in bodies, by which their specific identity is not destroyed, whilst *Chemistry* treats of those changes which affect the specific identity of the bodies.

Materia Medica (medicinal materials) is a term applied to designate the substances which are used in the cure of diseases; it is most intimately connected with *Pharmacognosy*, the science which treats of crude drugs, whilst the specific definition of Pharmacy limits the latter to the consideration of the preparations made from drugs.

In Colleges of Pharmacy, as well as in Universities where pharmacy is a part of the instruction, it is usual to divide General Pharmacy into three departments,—Chemistry, Botany and Materia Medica, and Theory and Practice of Pharmacy.

Toxicology, the science of poisons, and *Microscopy*, which requires the use of optical instruments called Microscopes, form valuable collateral and special subjects of study.

Practical Pharmacy is that branch of Pharmacy which treats of the operations, processes, and methods used in applying the principles of theoretical pharmacy. The practice of pharmacy will receive in this treatise much the greater share of attention; separate text-books on the sciences pertaining to the theory of pharmacy are now very accessible, and these may be referred to for specific and systematic information.

PHARMACOPŒIAS AND DISPENSATORIES.

A *pharmacopœia*, in the modern acceptation of the word, is a book containing a list of medicinal substances,[1] with descriptions, tests, and formulas for preparing the same, selected by some recognized authority. The necessity for legalized standards to define the character, establish the purity, and regulate the strength of medicines is recognized by all civilized nations; and although all of the nations of the globe have not yet formally adopted national standards, in nearly every case where this has not been done it will be found that the standards of some other country are in use. The most important pharmacopœias, with the dates of their last issue, are as follows:

OFFICIAL PHARMACOPŒIAS.[2]

Nation.	*Date of Issue.*	*Title.*
1. United States	1893	Pharmacopœia of the United States of America. Seventh Decennial Revision (1890).
2. Great Britain and Ireland and Colonies	1885	British Pharmacopœia.
3. Germany	1890	Arzneibuch für das Deutsche Reich (Pharmacopœa Germanica).
4. France	1884	Codex Medicamentarius (Pharmacopée Française).
5. Austria	1889	Pharmacopœa Austriaca.
6. Belgium	1885	Pharmacopœa Belgica.
7. Chili	1886	Farmacopea Chilena.
8. Croatia-Slavonia	1888	Pharmacopœa Croatico-Slavonica.
9. Denmark	1893	Pharmacopœa Danica.
10. Greece	1868	Ἑλληνικὴ Φαρμακοποιία.
11. Hungary	1888	Pharmacopœa Hungarica.
12. India (East Indies)	1868	Pharmacopœia of India.
13. Italy	1892	Farmacopea ufficiale del Regno d'Italia.
14. Japan	1891	Pharmacopœa Japanica.
15. Mexico	1884	Nueva Farmacopea Mexicana.
16. Netherlands	1889	Pharmacopœa Neerlandica.
17. Norway	1879	Pharmacopœa Norwegica.
18. Portugal	1876	Pharmacopêa Portugueza.
19. Roumania	1874	Pharmacopœa Romana.
20. Russia	1891	Pharmacopœa Rossica.
21. Spain	1884	Farmacopea oficial Española.
22. Sweden	1879	Pharmacopœa Suecica.
23. Switzerland	1893	Pharmacopœa Helvetica.

[1] The word "official" is now used to designate pharmacopœial substances or preparations, the term "officinal" being obsolete in this connection; the latter is properly applied to substances or preparations kept in the shop but not recognized by a pharmacopœia.

[2] This list has been kindly revised by Charles Rice, Ph.D., 1894.

NOTES ON OFFICIAL PHARMACOPŒIAS.

1. In quoting this title, it is customary to abbreviate it to "U. S. P. (1890)." It is advisable to adhere to this form so as to preserve uniformity. The "seventh revision" means, of course, the same as "eighth edition."
2. A supplement under the title "Additions made in 1890 to the British Pharmacopœia of 1885" was published in 1890. A new Imperial Pharmacopœia is in preparation.
3. A supplement to the German Pharmacopœia, with the title "Nachtrag zum Arzneibuch des Deutschen Reiches," appeared at the end of 1893.
10. The Greek Pharmacopœia of 1868 is a reprint of that of 1837, with copious additions. It is no longer in practical use. The French and German Pharmacopœias are generally followed.
12. An addendum to the Pharmacopœia of India appeared in 1869. At present the British Pharmacopœia has practically superseded the work.
15. The Mexican Pharmacopœia is prepared and published by a Committee of the Mexican Pharmaceutical Society, but the government recognizes the work. A supplement ("Apendice") was published in 1890.
17. The Norwegian Pharmacopœia of 1879 is a reprint of the revision of 1870, with additions.
22. The Swedish Pharmacopœia of 1879 is the third reprint of the revision of 1869, with additions.
23. The Swiss Pharmacopœia is published simultaneously in three languages,—German, French, and Italian.

WORKS OF REFERENCE USED IN COUNTRIES POSSESSING NO NATIONAL PHARMACOPŒIA.

In France, Spain, Central and South American countries, and those West Indian Islands where French or Spanish is the principal language, the most generally used, unofficial work of reference is Dorvault's "L'Officine," an extensive commentary and supplement to the French Pharmacopœia, either in the French original, or in its Spanish translation and adaptation by Pontes.

ARGENTINE REPUBLIC.—French and Spanish Pharmacopœias. Also (not official) Tratado de Farmacia y Farmacognosia. By Carlos Murray.
BOLIVIA.—French, Spanish, and Chilian Pharmacopœias.
BRAZIL.—French, Portuguese, and Spanish Pharmacopœias. Also (not official) Formulario ou Guia Medica, etc. By P. L. N. Chernovitz. Novo Formulario medico e pharmaceutico, ou Vademecum Medicum. By Th. J. H. Langgaard.
CENTRAL AMERICAN STATES.—French, Spanish, and Mexican Pharmacopœias. Also, to some extent, the British and that of the United States.
CHINA.—The native druggists and herbalists still regard as their chief authority the old Chinese Encyclopedia of natural history, entitled Pen-tsao kang-mu, composed by Li-shi-chin between 1552 and 1578. The usual editions of this work are printed in 40 thin volumes, 8vo. Foreign pharmacists use the pharmacopœias of their respective countries. The British is most in use.
CUBA.—The Spanish and French Pharmacopœias.
ECUADOR.—French and Spanish, also several foreign pharmacopœias.
HAYTI.—French and Spanish Pharmacopœias (chiefly).
HAWAIIAN ISLANDS.—Chiefly the United States Pharmacopœia. To some extent, also, the British and the German.
LIBERIA.—The United States Pharmacopœia (chiefly).
PERU.—The French, Spanish, British, and United States Pharmacopœias.
TURKEY.—The French Pharmacopœia.
URUGUAY.—The French and Spanish Pharmacopœias. Occasionally, also, the British and that of the United States.
VENEZUELA.—The French and Spanish Pharmacopœias (chiefly). Also, occasionally, the British and that of the United States.

The official Pharmacopœias are all issued under the authority of the respective governments, with the exception of the United States Pharmacopœia (which has, however, been accepted by the government and a number of the individual States, especially New York and Ohio, as a standard in some of the departments), the policy of the nation having been against interference in matters which relate to restrictions upon professional practice. This course has not prevented the acceptance of the work by physicians and pharmacists as an authoritative guide, whilst it has probably encouraged a greater freedom in criticism, and thus

developed more general interest in a standard and a stronger desire for improvement than could have been obtained through compulsory legislation. Efforts are constantly put forth to secure the adoption of an International Pharmacopœia. If these should prove successful, a great advance will be made in bringing about a uniformity in the strength of preparations; yet it may well be doubted whether such a work would be as generally useful as the Pharmacopœias at present in use, which have been proved by long experience best adapted to the varying needs of the different nations.

The Pharmacopœia of the United States (1890), Seventh Decennial Revision, was prepared by a committee appointed by the National Convention for revising the Pharmacopœia, which met in Washington, D.C., May 7, 1890. Fifty-five medical bodies and fifty-five incorporated pharmaceutical organizations sent delegates to this convention, which selected from those present twenty-six members, consisting of fifteen pharmacists and eleven physicians, who were designated the Committee of Revision and Publication of the Pharmacopœia of the United States of America. As this book will be largely quoted in this treatise, its plan and the outlines of its main features should be thoroughly understood at the outset.

Nearly one thousand substances (989), embracing crude drugs and preparations, have been deemed of sufficient importance to merit a place in the United States Pharmacopœia. These substances were formerly divided into two classes, "Materia Medica" and "Preparations:" the former class contained a list of medicines which were either crude drugs or were furnished by manufacturers and not usually prepared by the pharmacist; the latter class was composed of formulas or processes indicating how preparations were to be made. At the Sixth Decennial Revision this arbitrary method of division was dropped, and a strictly alphabetical arrangement of all the substances adopted: this facilitates a ready reference, and disarms criticism upon a method of classification.

NOMENCLATURE.

The titles of the various substances are indicated—1st. By the OFFICIAL NAME, which is always in the Latin language. 2. By the ENGLISH NAME. 3d. By the SYNONYME. 4th. By the BOTANICAL NAME (in the case of plants). 5th. By the SYMBOLIC FORMULÆ (in the case of chemicals). Each of these names has a special use.

The following extracts from the Pharmacopœia are given in illustration:

CANTHARIS.	[Official name.]	**EMULSUM AMYGDALÆ.**
CANTHARIDES.	[English name.]	**EMULSION OF ALMOND.**
[SPANISH FLIES.]	[Synonyme.]	[MILK OF ALMOND.]
BISMUTHI CITRAS.	[Official name.]	**SINAPIS ALBA.**
BISMUTH CITRATE.	[English name.]	**WHITE MUSTARD.**

$BiC_6H_5O_7$ = 397.44. [Symbolic formula.]

The seed of *Brassica alba.* [Official definition, botanical name in italics.]

1. The Official Name.—Example, CERATUM CANTHARIDIS. The official name is thoroughly distinctive, and is intended to be used

in designating the drug or preparation where precision is required, as in writing prescriptions, in labelling store-furniture, specimens, etc. Latin is selected for the official title because it is universally used and understood as the "language of science," and is not liable to change, as is the case with a living tongue. Although the official names are usually abbreviated in practice,[1] the proper terminations and full titles should be known and observed carefully, and the habit of using the Latin abbreviations in English conversation strictly guarded against as not only inelegant, but vulgar.[2] A vast amount of careful consideration, extending over many years, has been expended in perfecting a system of pharmacopœial nomenclature which is at once "brief, simple, expressive, distinctive, and convenient." The following may be cited as models: Allium, Camphora, Opium, Rheum, Sapo, etc., the full pharmacopœial definition of these titles being, respectively, *Allium.* "The bulb of *Allium sativum* Linné (Nat. Ord., *Liliaceæ*)."[3] *Camphora.* "A stearopten (having the nature of a ketone) obtained from *Cinnamomum Camphora* (Linné) Nees et Ebermaier (Nat. Ord., *Laurineæ*), and purified by sublimation."[3] *Opium.* "The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* Linné (Nat. Ord., *Papaveraceæ*), and yielding, in its normal, moist condition, not less than *nine* (9) *per cent.* of crystallized morphine, when assayed by the process given below."[3] *Rheum.* "The root of *Rheum officinale* Baillon (Nat. Ord., *Polygonaceæ*)."[3] *Sapo.* "Soap prepared from soda and olive oil." The official definition in each case indicates as plainly as possible the source and the particular form of the drug or substance which is to be selected. The *generic* or genus name (the first part of the botanical name) was generally chosen for the official title, as, Pilocarpus, the official name for "the leaflets of *Pilocarpus Selloanus*" (botanical name). In the case of some old and very well known drugs, this rule could not be adopted without causing confusion, and the *specific* or species name (the second part of the botanical name) was retained, as Ipecacuanha, the official name for "the root of *Cephaëlis Ipecacuanha.*" The official title obviously cannot retain the simplicity of a single word where two parts of the same plant are official; thus, for example, the root and seed of Colchicum must each be defined by affixing the Latin name of the particular part of the plant intended, as, *Colchici Radix* for Colchicum Root and *Colchici Semen* for Colchicum Seed; nor can a single word be chosen for either official title where the specific names of two or more plants of the same genus differ; the generic name of the two official mints is Mentha, and to distinguish them it is necessary to use the full botanical name for each,—thus, *Mentha Piperita* (Peppermint), *Mentha Viridis* (Spearmint).

There are a very few exceptions to the above principles of nomenclature, as in the case of *Pareira* and *Prunus Virginiana*, derived, according to the most recent and reliable authorities, respectively from *Chondo-*

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[1] See table of abbreviations in chapter on Prescriptions.

[2] Example of what should be avoided in conversation: "I mixed the *Pulv. Pip. Nig.* with the *Pot. Carb.* and the *Muc. Trag.*, but could not form a mass."

[3] The words enclosed in quotation-marks are appropriately termed *the official definition.*

dendron tomentosum and *Prunus serotina;* these drugs are largely used, and the old names have become so well established that it would lead to confusion and possibly embarrassing mistakes to change them now. The Latin names are generally used in the singular number, although the definition of the drug distinctly indicates plurality; for instance, *Galla* is the official name for *nutgalls,* as they are termed commercially, and is in the nominative singular (plural, *Gallæ*); the official definition indicates the singular, being "An excrescence on *Quercus lusitanica.*" *Anthemis* (nominative singular) is the official name for the flower-heads of Chamomile. The reason assigned in the preface to the U. S. Pharmacopœia, 1850, for this apparent deviation, is that "the example of the Roman medical writers, particularly of Celsus, might be followed." In the case of compound medicines, such official titles were selected as would usually express the composition of the preparations as fully as possible, indicating the principal ingredients without sacrificing the important consideration of brevity and convenience in abbreviation, as, Mistura Rhei et Sodæ, Mistura Cretæ, Pulvis Ipecacuanhæ et Opii, Tinctura Opii Camphorata, Tinctura Aloes et Myrrhæ. Where the number of important ingredients in a preparation is too great to admit of a selection, the participial adjective *compositus* (meaning compound) is added, the feminine (*composita*) or neuter (*compositum*) termination being used respectively where the noun is feminine or neuter, as Spirit*us* Juniperi Composit*us* (masc.), Tinctur*a* Lavandulæ Composit*a* (fem.), Extract*um* Colocynthidis Composit*um* (neut.).

2. The English Name.—Example, SOLUTION OF AMMONIUM ACETATE. —The English name should be used when the drug or preparation is mentioned in ordinary conversation, in commercial transactions, in writing orders for supplies, and in all cases where the use of the Latin official name could be justly criticised as an ostentatious display of erudition. In the U. S. Pharmacopœia, 1880, a large number of English names used in former Pharmacopœias were changed, the old vernacular names being either dropped altogether or inserted as synonymes: this advanced step was rendered necessary by the increase in articles used in the materia medica and by a desire for greater accuracy and better methods in nomenclature. The confusion which always exists in different localities concerning the common names of drugs is also avoided, as the anglicized Latin name is distinctive. The former English names *Irish Moss, Pipsissewa, Butternut,* and *Wormseed,* for instance, are replaced by *Chondrus, Chimaphila, Juglans,* and *Chenopodium.*

On the other hand, some of the common English names were so fixed by usage that it was not deemed judicious to alter them; besides, to have changed them would have often substituted a longer and less convenient word. The retention of the English names *Cloves, Elm, Hops,* and *Ginger* sufficiently illustrates this.

In the U. S. Pharmacopœia, 1890, a very important change has been made in the English names of the chemical substances, the basylous or metallic component being now given the first place; for instance, *potassium citrate, ammonium bromide,* and *zinc sulphate,* replace the former names *citrate of potassium, bromide of ammonium,* and *sulphate of zinc.*

This change requires many alterations in nomenclature, but it was a necessary step for the Committee of Revision to make the names accord with the established usage of the best modern chemical writers. The salts of iron and mercury have been differentiated by the use of the terms *ous* and *ic* respectively to designate lower and higher forms of the salts; for example, ferr*ous* sulphate and ferr*ic* sulphate, mercur*ous* iodide and mercur*ic* iodide, are now used in preference to sulphate of iron and iodide of mercury; the compounds of mercury, on account of the differences in dose existing among them, are further distinguished by the use of the adjectives "corrosive," "mild," "red," "yellow." For the scale salts of iron, which are of complex composition and not true chemical salts, notwithstanding the fact that the metallic component exists in them in the ferric state, the term "iron" has been retained, in order to emphasize the fact of their defective chemical construction, for they are not definite double salts.

The pharmacopœial names of chemical substances do not always represent their chemical composition: the enormous multiplication of synthetic remedies, and the length of the systematic names of these bodies, have compelled the use of shorter terms which are more conveniently employed in prescriptions and in commercial transactions: thus, "metadioxybenzol" is a more cumbersome word than "resorcin," "phenyl salicylate" than "salol." If we turn to unofficial substances, a better example is afforded by the use of "trional" for "triethylsulphonmethylethylmethane;" but this is eclipsed by "analgen," which is dignified by the systematic name of "orthoethyloxyanamonobenzoylamidochinoline."

3. The Synonyme.—Example, [SPIRIT OF MINDERERUS.] In the Pharmacopœia the definition of the term synonyme is restricted to an equivalent name in common use, which is usually antiquated and derived from an unscientific source, and which should really be abandoned, but which common custom and long usage demand shall not be entirely ignored. The synonymes should be rarely or never used, yet it is necessary for the student to be familiar with them in order to recognize their equivalent official or English names when they are used by others. Common names, as snakeroot, dock, Indian hemp, balm, etc., have varying and often opposite meanings in different localities, and confusion and even loss of life have resulted from the unfortunate use of these common names.

4. The Botanical Name.—By this is meant the systematic name recognized by botanists for plants, which serves in pharmacopœial nomenclature as the basis of the official name. The botanical name usually consists of two Latin words, the first indicating the genus and the second the species to which the plant belongs. *Capsicum fastigiatum* is the botanical name for the particular variety of capsicum or Cayenne pepper which the Pharmacopœia designates; here the generic or first name is chosen for the official title, and if no description followed the title it would be inferred that any part of any plant in the genus "Capsicum" could be officially used for making preparations; but the specific name, "fastigiatum," limits the use to this species, whilst the description which follows shows the *part* of the plant which must be employed:

"the *fruit* of Capsicum fastigiatum." Now, Capsicum baccatum, Capsicum frutescens, Capsicum annuum, belonging to different species, are active members of the genus, but their claims are unrecognized, and the fruit from these species is not official. The specific name does not begin with a capital letter, except when it has been at some previous time itself a generic name, as in Rhamnus Frangula, or when it is derived from the name of a person, as in Garcinia Hanburii, or when the word is indeclinable, as in Theobroma Cacao, or when it is a combination of a noun and an adjective, as in Xanthoxylum Clava-Herculis. The name of the author follows the botanical name, as, *Capsicum fastigiatum* Blume, and after this the Natural Order[1] to which the plant belongs is indicated in italics, and the whole enclosed in parentheses, as, (Nat. Ord., *Solanaceæ*). It must be apparent that the botanical name need not be employed either in writing or speaking in ordinary pharmaceutical work; but its use is absolutely necessary in establishing the identity of any drug authorized by the Pharmacopœia, and hence it is important to know the botanical names.

5. The Symbolic Formulæ.—The adoption of certain arbitrary symbols[2] to represent chemical elements leads to a most convenient and useful application, whereby the composition of a chemical is expressed with the utmost brevity and exactness. Plumbi Iodidum and Lead Iodide are both much longer terms than "PbI_2," and not so definite. *Sodium Sulphite* does not always contain the same proportion of water of crystallization, and if the symbolic formula, $Na_2SO_3.7H_2O$, were not appended to the official title there might be some doubt about which sulphite was intended: the added $7H_2O$, however, accurately defines it. The *figures* which follow the symbolic formulæ indicate the *molecular weight* (the sum of the weight of the atoms) of the chemical: thus, in $MgSO_4.7H_2O = 245.84$, the atomic weight of Magnesium Mg, 24.3, is the first factor; this added to Sulphur S, 31.98, makes 56.28; Oxygen O, 15.96, multiplied by 4, gives 63.84; then Hydrogen having the atomic weight of 1 if multiplied by 2 and this by 7 gives 14, and seven times O, 15.96, is 111.72; then $56.28 + 63.84 + 14 + 111.72 = 245.84$, the molecular weight of magnesium sulphate.

The Official Description.—Immediately following the official definition of the substances there will be noticed in the Pharmacopœia, in smaller type, what has been termed the *official description*: this consists, usually, in drugs, of a concise statement of their physical characteristics, whilst in some cases tests of identity, with descriptions of the substances used as adulterants, are appended. In the chemicals the official definition is usually replaced by the symbolic formulæ, and these are followed immediately by the official description, which is printed in smaller type, exactly as in the case of the drugs; to this description are usually added the solubilities, with the tests of identity and purity of the substance. The following examples, selected from the Pharmacopœia, are given in illustration:

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[1] See index for chart of drugs arranged according to the Natural Orders.

[2] See index for table of elements, with symbols and atomic and molecular weights.

MYRRHA.	[Official name.]	**AMMONII NITRAS.**
MYRRH.	[English name.]	**AMMONIUM NITRATE.**
A gum-resin obtained from *Commiphora Myrrha* (Nees) Engler (Nat. Ord., *Burseraceæ*).	[Official definition.] | [Symbolic formula.]	$NH_4NO_3 = 79.9$.
In roundish or irregular tears or masses, dusty, brownish-yellow or reddish-brown; fracture waxy; . . . taste bitter and acrid. When triturated with water, Myrrh yields a brownish-yellow emulsion; with alcohol it yields a brownish-yellow tincture which acquires a purple tint on the addition of nitric acid.	[Official description.]	Colorless crystals, generally in the form of long, thin, rhombic prisms, or in fused masses. . . . Soluble in 0.5 part of water and in 20 parts of alcohol; very soluble in boiling water and in 3 parts of boiling alcohol. . . . The aqueous solution, when acidulated with nitric acid, should not be affected by test-solution of silver nitrate. . . .

THE PREPARATIONS OF THE PHARMACOPŒIA.

Although these will be considered in detail in the body of this work, a few general remarks on them will be appropriate here. The "parts by weight" plan adopted by the U. S. Pharmacopœia, 1880, was dropped in the 1890 revision, and the "solids by weight, liquids by measure" principle accepted. This is more in accord with the methods used in English-speaking countries. A great advance was made by the adoption of the metric system for expressing the quantities, which were thus also made definite. Every pharmacist should employ the metric system exclusively in making preparations; but on account of the revolutionary changes made necessary by the adoption of this system of weights and measures, corresponding quantities are given in the working formulas in this work, which are based on the old system of avoirdupois weight and apothecaries' measure. The latter will be found much less convenient than the metric quantities, especially if the operator has procured a set of metric weights and measures and has used them a few times.

DISPENSATORIES.

A dispensatory is a commentary on a pharmacopœia. The U. S. Pharmacopœia describes the drugs and chemical substances of the materia medica, establishes the degree of purity of many of them, and defines the strength of the preparations. The dispensatories comment on the substances, giving their physical, medical, and pharmaceutical history, with their doses and uses. The number of substances noticed in the Pharmacopœia is limited to such as are in common and frequent use in some section of the country. On the other hand, the dispensatories aim to present information about those which are official in our own and other Pharmacopœias, and those which are of occasional or rare use, in addition. There are at present two dispensatories which comment on the materia medica and preparations of the U. S. Pharmacopœia of 1890,—the United States Dispensatory,[1] which was first published in 1833, and the National Dispensatory, which was first issued in 1879.[2] The plans of these works are similar: the text of the Pharmacopœia is first inserted, and immediately following are appended the comments of the authors and editors. The arrangement of the subjects is now

[1] *United States Dispensatory*, 17th edition, edited by Wood, Remington, and Sadtler, published by J. B. Lippincott Company, Philadelphia.

[2] *National Dispensatory*, Stillé and Maisch, published by Lea Brothers & Co., Philadelphia.

strictly alphabetical, the United States Dispensatory dividing them, however, into two classes, distinguished by type of two sizes: the principal portion of the work, that in the largest type, is devoted to a commentary on the preparations of the United States and other Pharmacopœias; the unofficial and less important subjects are to be found in the second part. In the National Dispensatory the unofficial substances are considered either in the body of the book or under subdivisions as allied drugs. The possession of a reliable commentary upon the Pharmacopœia is a *necessity* which is fully realized by pharmacists, and in the consideration of the subjects in the succeeding chapters of this work this fact has not been lost sight of. The United States Dispensatory is now preferred as a guide, and hence will be frequently quoted.

QUESTIONS ON INTRODUCTORY CHAPTER.

Define Pharmacy. (See page 25.)

In what respects is Pharmacy an art as well as a science, and what does it comprehend?

Is the word Pharmacy ever applied to any particular place? If so, how?

Into what two classes is Pharmacy divided?

Name and define the sciences which form the basis of Theoretical Pharmacy.

Define Materia Medica.

What is the name of the science which treats of crude drugs?

In what respect does this science differ from Pharmacy in its specific sense?

What is Toxicology?

Of what does Microscopy treat?

Define Practical Pharmacy.

What is a Pharmacopœia?

Explain what is meant by the terms "official" and "officinal."

Give the titles and last dates of issue of four of the most important Pharmacopœias.

Are all Pharmacopœias issued under authority of government?

If not, name an exception.

When was the present U. S. Pharmacopœia prepared?

How was it prepared?

How many members constituted the final committee of revision?

How many substances having separate titles are contained in the Pharmacopœia?

What classification or arrangement of the various drugs and medicines has been accepted?

In the nomenclature of the Pharmacopœia, how are the titles of the various substances indicated?

What is the official name of White Mustard?

What is the botanical name of White Mustard?

What is the English name of Cantharis?

What is the synonyme of Cantharis?

What is the symbolic formula of Bismuthi Citras?

What is the official definition of Sinapis Alba?

What is the object of having an official name, and what use is made of it?

Why is the Latin language selected for the official names?

Under what circumstances is it allowable to abbreviate official names?

When are abbreviations improper?

What does the official definition indicate?

In choosing the official name, what part of the botanical name of a plant is preferred?

What exceptions are there to this rule?

When several parts of the same plant are used, how are they distinguished?

When two or more plants of the same genus are official, how are they distinguished?

Are the Latin names of drugs usually in the singular or the plural number?

What reason is assigned for this?

In the case of compound medicines, how have the names been selected?

Where medicines have too many important ingredients to admit of selection, how have they been named?

What is meant by the English name of a pharmaceutical substance?

Under what circumstances should the English name be used?

The common or popular names having been discarded and other names substituted, what, for example, are the present names of the drugs formerly known as Irish Moss, Pipsissewa, Bittersweet, Wormseed?

Why has this change been made?

Have all the common names been changed? If not, give an example and the reason why it was not changed.

What important change in the English names of chemical substances was made in the U. S. Pharmacopœia of 1890? Why was this done?

How are the higher and lower forms of the salts of iron and mercury differentiated? Give an example.

How are the compounds of mercury further distinguished?

Why is the term "iron" retained for the scale salts of iron?

Do the pharmacopœial names of chemical substances always represent their chemical composition? If not, give an example of one that does not, and the reason for not using the systematic name.

What is meant by a synonyme?

Is it desirable to increase the use of synonymes?

Why are they used?

What is meant by the botanical name of a plant?

How is it usually derived?

Why is it important to know the botanical names of plants?

What is the meaning of the official abbreviation "Nat. Ord." used after the botanical name?

What are symbolic formulas?

What are the objects of their employment?

What do the figures following a symbolic formula indicate?

What is meant by molecular weight?

What is an atom?

What is meant by the official description of a drug?

What are the objects of having official descriptions?

Describe the principle of weight and measure adopted by the U. S. Pharmacopœia of 1890.

How are the quantities expressed in the late Pharmacopœia? Which system is preferable?

What is a Dispensatory?

Name the two principal Dispensatories published in the United States.

PART I.

CHAPTER I.

METROLOGY.

Weight, Measure, and Specific Gravity.

Metrology formerly and according to its strictest signification meant the science of measures, but its present definition includes the measure of the gravitating force of bodies, which always bears a direct ratio to their mass, and is commonly called *weight;* the determination of the bulk or extent of the body, its *measure;* and the relation which measure bears to weight when compared with a standard is known as *specific gravity.*

WEIGHT.

A knowledge of the systems of weights and measures in use must necessarily command the early attention of the student, and a short account of the origin of the present systems may be of service in fixing upon the mind the essential distinctions between them. The sense of the weight of a body cannot be conveyed intelligibly to the mind unless a means of comparison is chosen, and as weight is the measure of the gravitating force of a body, so this force is expressed as related to a standard of resistance, this being exactly that which would balance the body and keep it in equilibrium. Such standards are termed *weights.*

The standards which have been chosen by various nations are arbitrary, and instances are common where different standards are in use at the same time in the same country. Many of the ancient standards are clearly referable to parts of the human body, as nail, foot, span, pace, cubit (length of the forearm), orgyia (stretch of the arms). In the history of metrology three periods may be traced: 1. The *Ancient,* during which the old classical standards originated, and which terminated with the decline of the Roman Empire. 2. The *Mediæval,* extending to the sixteenth century. In this period the old standards were lost, but their names were preserved, and European nations adopted various independent standards. 3. The *Modern.* Since the seventeenth century the efforts of most enlightened nations have been directed towards greater

accuracy and simplicity, and during the present century towards international uniformity.

In Great Britain, in the year 1266, the 51st act of the reign of Henry III. declares "that by the consent of the whole realm of England the measure of the King was made,—that is to say, that an English silver penny called the sterling, round and without clipping, shall weigh *thirty-two grains of wheat,* well dried and gathered out of the middle of the ear; and twenty pence (pennyweights) do make an ounce, and twelve ounces a pound, and eight pounds do make a gallon of wine, and eight wine gallons do make a bushel, which is the eighth of a quarter."

The sixteen-ounce pound (avoirdupois) was derived from a more ancient source, and was undoubtedly of Roman origin, and introduced at the time of the first civilization of the British island. The word "haberdepois," according to Gray, was, however, first used in English laws in 1303.

A statute of Edward I. (A.D. 1304) states "that every *pound* of money or of *medicines* is of *twenty shillings weight,* but the pound of all other things is *twenty-five shillings weight.* The *ounce* of *medicines* consists of *twenty pence,* and the *pound* contains *twelve* ounces (the Tower Pound), but in other things the pound contains *fifteen* ounces, in both cases the ounce weighing twenty pence."

These laws unfold the theory of the ancient weights and measures of Great Britain, and reveal the standard,—*i.e.,* a natural object, grains of wheat; a difference existed then between the troy and the avoirdupois pound, but the weights now in use are one-sixteenth heavier than those of Edward I., owing to the change made in the value of the coin by the sovereign subsequently; in addition to this, the true pennyweight standard was lost, and on the next revision of the weights and measures the present troy and avoirdupois standards were adopted. The old Tower or troy ounce and the avoirdupois ounce were intended to have the same weight, but after the revision it was found that the troy ounce was heavier than the avoirdupois ounce by forty-two and a half grains.

The subsequent adoption of troy weight by the London College of Physicians in 1618, on the recommendation of Sir Theodore Turquet de la Mayerne, who compiled their first Pharmacopœia, has entailed upon all apothecaries who are governed by British customs, to this day, the very great inconvenience of buying and selling medicines by one system of weights and compounding them by another.

In the next century efforts were made towards reforming the standards, and the Royal Society, in 1736, began the work, which ended in the preparation, under the direction of the House of Commons, by Mr. Bird, of the standard "yard" and standard "pound" troy in 1760. Copies of these have been made, no intentional deviation has been made since, and they are still the standards used most largely in the United States. In 1816, on account of the growing popularity of the French metrical system, and in view of the desirability of securing a standard which could easily be recovered in case of loss or destruction and which should be commensurable with a simple unit, steps were taken in England to secure these advantages. The labors of English scientists

led to the adoption of the *Imperial* measures and standards, which were legalized January 1, 1826, and are now in general use in Great Britain. In this system the *yard* is equivalent to 36 inches, and its length was determined by comparison with a pendulum beating seconds of mean time, in a vacuum, at the temperature of 62° F. at the level of the sea, in the latitude of London, which length was found to be 39.1393 inches. The *pound troy* (containing 5760 grains) was determined by comparison with a given measure of distilled water under certain conditions: thus, a cubic inch of distilled water was weighed with brass weights in air at 62° F., the barometer at 30 inches, and it weighed 252.458 grains. The standard for measures of capacity (either dry or liquid) is the *gallon*, and this contains 10 pounds avoirdupois (each 7000 grains) of distilled water weighed in air at 62° F., the barometer standing at 30 inches; the *bushel* containing 8 such gallons. In 1819–20 efforts were made in the United States to secure uniformity in the standards which were in use by the several States. Finally, after a lengthy investigation, the Secretary of the Treasury, on June 14, 1836, was directed by Congress to furnish each State in the Union with a complete set of the revised standards, and thus we have the *troy pound* (5760 grains), the *avoirdupois pound* (7000 grains), and the *yard* (36 inches) all identical with the British standards; but the *gallon* is quite different, the old wine gallon of 231 cubic inches, containing 58372.2 grains of distilled water at its maximum density, weighed in air of the temperature of 62° F., the barometer standing at 30 inches, *being retained*, whilst the bushel contains 77.6274 pounds of water under the same conditions.[1] In 1864 the use of the metric measures was legalized in Great Britain, but not made compulsory, and in 1866 the United States followed the same course.

Apothecaries' Weight (also called Troy Weight).

Pound.		Troy Ounces.		Drachms.		Scruples.		Grains.
℔ 1	=	12	=	96	=	288	=	5760
		℥ 1	=	8	=	24	=	480
				ʒ 1	=	8	=	60
						℈ 1	=	gr. 20

The British Pharmacopœia has adopted avoirdupois weight, which is also in general use in the United States for commercial purposes.

Avoirdupois Weight.

Pound.		Ounces.		Grains.
℔ 1	=	16	=	7000
		oz. 1	=	437.5

It will be observed that the troy ounce contains 42½ grains *more* than the avoirdupois ounce, whilst the troy pound contains 1240 grains *less* than the avoirdupois pound. Fortunately, one unit common to troy, apothecaries', and avoirdupois weight has been saved,—namely, *the grain*. The abbreviations of the denominations of apothecaries' weight are represented by the signs ℥, ounce, ʒ, drachm, ℈, scruple, and gr. grain; these have long been in use, but are very likely to be mistaken for one

[1] Slight variations in these original equivalents are recommended by various investigators, and have been in use since Hassler made his report in 1832. (See Barnard on the Metric System, page 153.)

another in rapid or careless writing. The abbreviations or signs for avoirdupois weight differ from those of troy weight, and care should be used not to confound them; they are ℔., pound, oz., ounce, gr., grain.

MEASURES.

Apothecaries' or Wine Measure, U.S.

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.
Cong. 1	=	8	=	128	=	1024	=	61440
		O 1	=	16	=	128	=	7680
				f℥ 1	=	8	=	480
						fʒ 1	=	♏ 60

Imperial Measure, Br.

(Adopted by the British Pharmacopœia.)

Gallon.		Pints.		Fluidounces.		Fluidrachms.		Minims.
C. 1	=	8	=	160	=	1280	=	76800
		O 1	=	20	=	160	=	9600
				fl. oz. 1	=	8	..	480
						fl. dr. 1	=	min. 60

When the subject of the weights and measures in ordinary use is studied, the want of simplicity and close relation is clearly apparent. The pint of distilled water at 15.6° C. (60° F.) weighs 7291.2 grains, the fluidounce 455.7 grains, and we have thus three ounces in use of different values,—troy ounce 480 grains, avoirdupois ounce 437.5 grains, and fluidounce 455.7 grains.

The Imperial measure differs from our wine measure principally in having twenty fluidounces in the pint instead of sixteen: a convenient relation exists, however, between measure and weight in the *Imperial gallon, which contains ten avoirdupois pounds of water* at 15.6° C. (60° F.).

The Imperial fluidounce contains the same number of grains as the avoirdupois ounce (437.5), which is 18.2 grains less than that of the U. S. fluidounce of water at the same temperature (455.7). Although this difference may be considered trifling in one fluidounce, it is not so when multiplied by four or eight, and this is one serious objection to the use of the English graduated measures in the United States, because they indicate Imperial fluidounces instead of U. S. fluidounces.

Approximate Measures.

In apportioning doses for a patient, the practitioner is usually compelled to order the liquid medicine to be administered in certain quantities that have been established by custom, and estimated as follows:

A tumblerful . . . . f℥viij.
A teacupful . . . . f℥iv.
A wineglassful . . . . f℥ij.
A tablespoonful . . . . fʒiv.
A dessertspoonful . . . . fʒij.
A teaspoonful . . . . fʒi.
A drop, through a popular error, is considered to be 1 minim.[1]

In almost all cases the modern teacups, tablespoons, dessertspoons, and teaspoons, after careful tests by the author, were found to average twenty-five per cent. greater capacity than the theoretical quantities given above; and the use of accurately graduated medicine-glasses, which may be had now at a trifling cost, should be insisted upon.

[1] See comparative table, p. 73.

The Metric System.—This system, which originated with Prince de Talleyrand, Bishop of Autun, France, in 1790, seems destined to become universal, as it is now legally used by the majority of all civilized nations, and finds especial favor with scientists even in countries where its use is not compulsory. The starting-point was the *unit of length*, the **metre**, which is the $\frac{1}{40,000,000}$ part of the earth's circumference around the poles. From this, the *unit of capacity* was derived, the **litre**, which is the cube of $\frac{1}{10}$ part of a metre. The *unit of weight*, the **gramme**, was also derived from the metre, it being the weight of that quantity of distilled water, at its maximum density, 4° C. (39.2° F.), which will fill the cube of $\frac{1}{100}$ part of a metre.[1] The name Metrical System, it will thus be seen, is very appropriate, as *each unit is derived from the metre;* it is also known as the *Decimal System*, because in obtaining the multiples and subdivisions the number ten (*decem*) is used solely. The prefixes, which indicate *multiplication*, are of Greek derivation, and are usually spelled with a capital letter,—**Deka**, 10, **Hecto**, 100, **Kilo**, 1000, **Myria**, 10,000; whilst *division* of the units is expressed by Latin prefixes, the initial letters not being capitals,—**deci**, $\frac{1}{10}$, **centi**, $\frac{1}{100}$, **milli**, $\frac{1}{1000}$. The word Gild has been suggested as a useful mnemonic, thus,—

G I L D
reek ncreases, atin ecreases.

The following table gives a view of the system adapted to the use of the student:

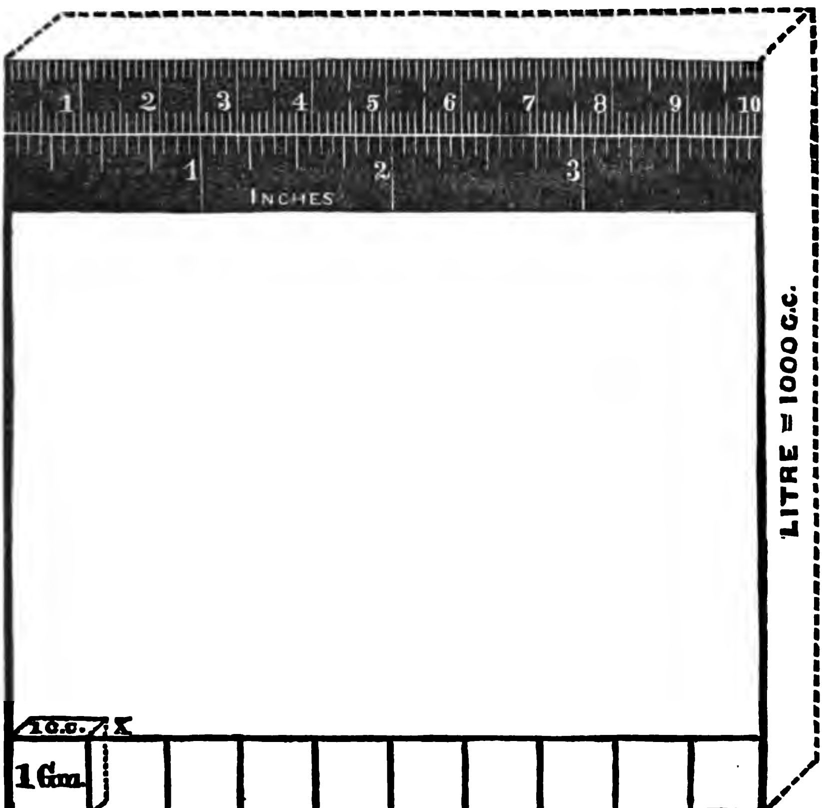
Abbreviation.	Metre.	Abbreviation.	Litre.	Abbreviation.	Gramme.
1 milli metre, mm. =	.001	1 milli litre, ml. =	.001	1 milli gramme, mg. =	.001
1 centi metre, cm. =	.01	1 centi litre, cl. =	.01	1 centi gramme, cg. =	.01
1 deci metre, dm. =	.1	1 deci litre, dl. =	.1	1 deci gramme, dg. =	.1
Metre, M.	1.	**Litre, L.**	1.	**Gramme, Gm.**	1.
1 Deka metre, Dm. =	10.	1 Deka litre, Dl. =	10.	1 Deka gramme, Dg. =	10.
1 Hecto metre, Hm. =	100.	1 Hecto litre, Hl. =	100.	1 Hecto gramme, Hg. =	100.
1 Kilo metre, Km. =	1000.	1 Kilo litre, Kl. =	1000.	1 Kilo gramme, Kg. =	1000.
1 Myria metre, Mm. =	10000.	1 Myria litre, Ml. =	10000.	1 Myria gramme, Mg. =	10000.

In pharmaceutical practice a number of the above measures are rarely or never used. Of the measures of length, the *millimetre* (mm.) and *centimetre* (cm.) are employed in the U. S. Pharmacopœia in the descriptions of drugs, accompanied by the equivalent measure in inches or its fractions, whilst in microscopy, *micromillimetre* (mkm.), signifying the thousandth part of a millimetre, is sometimes used. In measures of capacity, the term *millilitre* is generally replaced by *cubic centimetre* (C.c.) in chemical and pharmaceutical practice, whilst it and the litre are alone chosen as the most convenient units. In weight, the *milligramme*, *centigramme*, *gramme*, and *kilogramme* are selected; the latter being the commercial unit for larger quantities of drugs, and called *kilo*. This habit of appropriating only certain of the most convenient denominations for practical work has an analogy in the disuse of the theoretical terms of the system of United States coinage: thus, the double-eagle, eagle, and dime are ignored, whilst dollars and cents are preferred as

[1] The unit of surface measure, the *are*, being the square of ten metres, and the unit of solid measure, the *stere*, having the capacity of a cubic metre, need not claim the attention of the practical pharmacist.

units. The principal merits of the metric system are: 1. That every weight and measure bears a simple relation to the initial unit, the metre. 2. That every unit is multiplied or divided by the same number (*i.e.*, 10) to obtain the various denominations, and increase or decrease is expressed by simply moving the decimal point. 3. Its almost universal adoption makes it an international system.

FIG. 1.



Metric diagram.

Length.—*Metre.* One side of the above square measures 1 decimetre; it is graduated into tenths (*centimetres*); and these into tenths (*millimetres*); (the scale beneath shows the comparison with inches): 10 decimetres = 1 METRE = 39.370432 in. (remember three threes, 3 ft., 3 in., 3 eighths).

Capacity.—*Litre.* A hollow cube having each side of the same size as the square would hold a LITRE = 1000 C.c. = 2.113433 pints.

Weight.—*Gramme.* The weight of distilled water at 4° C. (39.2° F.) contained in a cube of the size of X ($\frac{1}{1000}$ of a litre) is equal to a GRAMME = 15.43234874 grains, and measures 1 *cubic centimetre.*

The advantages of the metric system have become more and more apparent upon examination, and its simplicity, brevity, and adaptability to every-day needs are now universally conceded. The progress which it had made in this country up to 1890 fully warranted its exclusive adoption in the U. S. Pharmacopœia: hence definite quantities are given and metric weights and measures are alone employed. The necessity for knowing thoroughly the denominations of all the systems in present use is one of the evils common to the age in which we live; and it must ever be a source of regret that when the young Republic, more than a century ago, abolished the complex system of coinage and adopted the decimal system, it did not go a step further and adopt the same principle in weights and measures.

The chief disadvantage of the metric system is one which inheres to the decimal principle of arithmetic,—namely, that the number ten cannot be divided more than once without producing a fraction, as, 10, 5, 2.5, 1.25, 0.625. The practice of dividing five into the three parts of 2, 2, and 1 partly compensates for this defect; and metric weights are constructed on this principle. The use of the metric weights and measures in the text of the U. S. Pharmacopœia makes it necessary for every pharmacist to become familiar with them, and therefore an easy method of remembering their relations to one another and their equivalents in other systems is desirable. The following equivalents are derived from those established by Congress for use in legal proceedings, or are based upon the trustworthy determinations of Captain Clarke and Prof. Miller, whilst the accompanying rules, which show the methods of using the equivalents, are preferred, on account of giving more accurate results. When very fine calculations are unnecessary, it will be found that the tables of equivalents given on pages 44 and 45 will prove sufficiently accurate for most pharmaceutical work.

To convert metric weights or measures into those in ordinary use:

RULE.—**Multiply the metric quantities by the corresponding equivalent.**

Ex.—The equivalent of *one metre* is 39.370+ inches, and five metres would be 196.85 inches: 39.370 × 5 = 196.85. To convert

Metres	into *inches,*	multiply by	39.370
Centimetres	" *inches,*	"	0.3937
Millimetres	" *inches,*	"	0.03937

As *one litre,* or 1000 *C.c.,* is equal to 33.8149+ fluidounces, or 35.235 Imperial fluidounces, to convert

Litres	into *fluidounces,*	multiply by	33.815
Cubic centimetres	" *fluidounces,*	"	0.0338
Litres	" *pints,*	"	2.113
Litres	" *Imperial pints,*	"	1.7617
Litres	" *Imperial gallons,*	"	0.2202
Cubic centimetres	" *Imperial fluidounces,*	"	0.0352

As *one gramme* is equal to 15.432+ grains, or .03527 avoirdupois ounce, or .03215 troy ounce, to convert

Grammes	into *grains,*	multiply by	15.432
Centigrammes	" *grains,*	"	0.15432
Milligrammes	" *grains,*	"	0.01543
Kilogrammes	" *avoirdupois ounces,*	"	35.2739
Grammes	" *avoirdupois ounces,*	"	.03527
Kilogrammes	" *avoirdupois pounds,*	"	2.2046
Kilogrammes	" *troy ounces,*	"	32.1507
Grammes	" *troy ounces,*	"	.03215

To convert the weights and measures in ordinary use into metric weights and measures:

Rule.—Multiply the quantities by the corresponding metric equivalent.

As *one inch* is equal to 0.0254 metre, *one fluidounce* to 29.572+ cubic centimetres, *one Imperial fluidounce* to 28.3807 cubic centimetres, *one grain* to 0.0648 gramme, *one avoirdupois ounce* to 28.3495 grammes, and one *troy ounce* to 31.1035 grammes, to convert

Inches	into *metres,*	multiply by	0.0254
Inches	" *centimetres,*	"	2.5399
Inches	" *millimetres,*	"	25.3997
Pints	" *litres,*	"	0.4731
Fluidounces	" *cubic centimetres,*	"	29.572
Imperial pints	" *litres,*	"	0.5676
Imperial gallons	" *litres,*	"	4.5409
Imperial fluidounces	" *cubic centimetres,*	"	28.3807
Grains	" *grammes,*	"	0.0648
Grains	" *centigrammes,*	"	6.4799
Grains	" *milligrammes,*	"	64.799
Avoirdupois ounces	" *kilogrammes,*	"	0.02835
Avoirdupois ounces	" *grammes,*	"	28.3495
Avoirdupois pounds	" *kilogrammes,*	"	0.4536
Troy ounces	" *kilogrammes,*	"	0.0311
Troy ounces	" *grammes,*	"	31.1035

It will be observed that there is a slight difference in the smaller quantities, increasing in the larger, between the equivalents in the following tables and those above given: this is owing to the fact that the temperature used as the basis for the metric units is 4° C., instead of 15.6° C., the usual temperature in practice, and the equivalents in the old form weights and measures in the table must correspond. The column upon the left of the page gives the weight in grains from one hundred pounds down; the difference in value from the next column is due to the variation in temperature standards: the fluidounce equivalent at 15.6° C. (60° F.) is 455.7 grains; the fluidounce at 4° C. (39.2° F.) in vacuo is 456.392 grains. For practical work in pharmacy the discrepancy is too trivial to give serious annoyance.

TABLE OF METRIC AND OLD FORM EQUIVALENT WEIGHTS AND MEASURES.

(100 lbs. av. to $\frac{1}{1000}$ of a grain.)

Weights, Old Form.					Metric Weight and Measure.	Measures, Old Form.				
Equivalent in grains. (Temp. 15.4° C., 60° F.)*	Grains.	Avoirdupois.				Fluid.				Fluid-ounces and fractions.
		lb.	oz.	grains.	Gm.] [Cc.	gal.	pts.	fluid oz.	minims.	
698938.5	**700000**	**100**	...	......	45359.2	11	7	13	369.1	1533.769
693403.1	694456.0	99	3	143.5	**45000**	11	7	1	298.6	1521.622
677994.3	679023.7	97	0	23.7	**44000**	11	4	15	388.0	1487.808
663991.8	**665000**	**95**	...	......	43091.3	11	3	1	38.9	1457.081
647176.5	648159.0	92	9	221.5	**42000**	11	0	12	86.9	1420.181
641625.6	642599.6	91	12	349.6	41639.8	**11**	...	...	......	**1408**
629044.6	**630000**	**90**	...	......	40823.3	10	6	4	188.2	1380.392
616358.4	617294.3	88	2	419.3	**40000**	10	4	8	265.4	1352.553
594097.5	**595000**	**85**	...	......	38555.4	10	1	7	337.4	1308.703
585540.3	586429.5	83	12	179.5	**38000**	10	0	4	444.0	1284.925
583296.0	584181.4	83	7	118.9	37854.3	**10**	...	...	......	**1280**
559150.7	**560000**	**80**	...	......	36287.4	9	4	11	7.2	1227.015
554722.7	555564.8	79	5	377.3	**36000**	9	4	1	142.8	1217.298
524966.4	525763.3	75	1	325.8	34068.9	**9**	...	...	......	**1152**
524203.6	**525000**	**75**	...	......	34019.4	8	7	14	156.5	1150.326
523904.2	524700.1	74	15	137.6	**34000**	8	7	13	320.1	1149.669
493086.5	492835.4	70	8	335.3	**32000**	8	3	10	20.2	1082.042
489256.8	**490000**	**70**	...	......	31751.5	8	3	1	306.2	1073.638
466636.8	467345.2	66	12	95.2	30283.5	**8**	...	...	......	**1024**
462268.9	462970.7	66	2	95.7	**30000**	7	7	6	199.2	1014.415
454309.7	**455000**	**65**	...	......	29483.5	7	6	4	455.5	996.949
431450.8	432106.0	61	11	293.4	**28000**	7	3	2	377.8	946.787
419362.9	**420000**	**60**	...	......	27215.5	7	1	8	......	920.261
408307.2	408927.0	58	6	302.0	26498.0	**7**	...	...	......	**896**
400632.8	401241.3	57	5	53.8	**26000**	6	6	15	76.3	879.159
385224.2	385808.9	55	1	371.4	**25000**	6	4	13	166.1	845.346
384416.2	**385000**	**55**	...	.....	24947.6	6	4	11	275.0	843.573
369815.1	370376.6	52	14	251.6	**24000**	6	2	11	255.4	811.532
349977.6	350509.0	50	1	71.4	22712.6	**6**	...	...	......	**768**
349469.1	**350000**	**50**	...	......	22679.6	5	7	14	424.3	766.884
338997.1	339511.8	48	8	11.8	**22000**	5	6	7	434.0	743.904
314522.3	**315000**	**45**	...	......	20411.7	5	3	2	94.1	690.196
308179.0	308647.1	44	1	209.6	**20000**	5	2	4	132.5	676.276
291648.0	292090.7	41	11	178.2	18927.2	**5**	...	...	......	**640**
279575.1	**280000**	**40**	...	......	18143.7	4	6	5	243.4	613.507
277360.9	277782.4	39	10	407.4	**18000**	4	6	0	311.0	608.648
246543.3	246917.7	35	4	167.7	**16000**	4	1	13	10.1	541.021
244628.4	**245000**	**35**	...	......	15875.7	4	1	8	393.1	536.819
233318.4	233672.6	33	6	47.6	15141.7	**4**	...	...	......	**512**
231134.2	231485.3	33	1	47.8	**15000**	3	7	11	99.4	507.207

* For explanation, see page 43.

Weights, Old Form.					Metric Weight and Measure.		Measures, Old Form.				
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Avoirdupois. lb.	oz.	grains.	Gm.]	[Cc.	Fluid. gal.	pts.	fluid oz.	minims.	Fluid-ounces and fractions.
215725.2	216053.0	30	13	365.5	14000		3	5	9	188.6	473.393
209763.3	210000	30	...	......		13607.8	3	4	12	62.9	460.131
184907.1	185188.3	26	7	125.8	12000		3	1	5	367.2	405.765
174988.8	175254.4	25	0	254.4		11356.3	3	...	...	......	384
174734.5	175000	25	...	......		11339.8	2	7	15	212.2	383.442
154089.5	154323.6	22	0	323.6	10000		2	5	2	66.2	338.138
139787.3	140000	20	...	......		9071.8	2	3	2	361.4	306.753
138680.4	138891.2	19	13	203.7	9000		2	3	0	155.5	304.324
123718.6	123456.9	17	10	83.9	8000		2	0	14	245.2	270.511
116659.2	116836.3	16	11	23.8		7570.9	2	...	...	......	256
107862.8	108026.5	15	6	401.5	7000		1	6	12	334.6	236.697
104840.6	105000	15	...	......		6803.9	1	6	6	31.2	230.065
97851.4	98000	14	...	......		6350.3	1	5	6	349.2	214.728
92453.7	92594.1	13	3	281.6	6000		1	5	4	423.8	202.883
90862.0	91000	13	...	......		5896.7	1	4	7	187.2	199.390
83872.6	84000	12	...	......		5443.1	1	3	8	25.1	184.052
77044.8	77161.8	11	0	161.8	5000		1	2	9	33.1	169.069
76883.2	77000	11	...	......		4989.5	1	2	8	343.2	168.715
69893.9	70000	10	...	......		4535.9	1	1	9	180.9	153.377
69340.3	69445.6	9	14	320.6	4500		1	1	8	77.8	152.162
62904.4	63000	9	...	......		4082.3	1	...	10	18.8	138.039
61635.8	61729.4	8	13	41.9	4000		1	...	7	122.5	135.255
58329.6	58418.1	8	5	230.6		3785.4	1	...	...	......	128
55915.1	56000	8	...	......		3628.7	...	...	122	336.7	122.701
53931.3	54013.2	7	11	200.7	3500		...	...	118	167.2	118.348
48925.7	49000	7	...	......		3175.1	...	...	107	174.6	107.364
46226.9	46297.1	6	9	359.6	3000		...	...	101	211.9	101.441
45570.0	45639.2	6	8	139.2		2957.4	...	...	100	......	100
43747.2	43813.6	6	4	63.6		2839.1	...	...	96	......	96
41936.3	42000	6	...	......		2721.6	...	...	92	125.3	92.026
41013.0	41075.3	5	13	387.8		2661.6	...	...	90	......	90
38522.6	38580.9	5	8	80.9	2500		...	...	84	256.8	84.535
36456.0	36511.4	5	3	198.9		2365.9	...	...	80	......	80
34946.9	35000	5	...	......		2268.0	...	...	76	330.2	76.688
31899.0	31947.4	4	9	9.9		2070.2	...	...	70	......	70
30817.9	30864.7	4	6	239.7	2000		...	...	67	301.2	67.628
29276.9	29321.5	4	3	9.0	1900		...	...	64	118.1	64.246
29164.8	29209.1	4	2	334.1		1892.7	...	...	64	......	64
27957.5	28000	4	...	......		1814.4	...	...	61	168.4	61.351
27736.1	27778.2	3	15	215.7	1800		...	...	60	415.1	60.865
27342.0	27383.5	3	14	258.5		1774.4	...	...	60	......	60
26195.2	26235.0	3	11	422.5	1700		...	...	57	232.1	57.484
24654.3	24691.8	3	8	191.8	1600		...	...	54	49.0	54.102
23113.4	23148.5	3	4	398.5	1500		...	...	50	346.0	50.721
22785.0	22819.6	3	4	69.6		1478.685	...	...	50	......	50
22329.3	22363.2	3	3	50.7		1449.111	...	...	49	......	49
21873.6	21906.8	3	2	31.8		1419.538	...	...	48	......	48
21572.5	21605.3	3	1	167.8	1400		...	...	47	162.8	47.339
21417.9	21450.4	3	1	12.9		1389.964	...	...	47	......	47
20968.1	21000	3	...	......		1360.778	...	...	46	6.3	46.018
20962.2	20994.0	2	15	431.5		1360.390	...	...	46	......	46
20506.5	20537.6	2	14	412.6		1330.817	...	...	45	......	45

Weights, Old Form.					Metric Weight and Measure.	Measures, Old Form.				
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Avoirdupois.				Fluid.				Fluid-ounces and fractions.
		lb.	oz.	grains.	Gm.] [Cc.	gal.	pts.	fluid oz.	min-ims.	
20050.8	20081.2	2	13	393.7	1301.243	...	...	44	......	44
20031.7	20062.1	2	13	374.6	1300	...	...	43	459.8	43.958
19595.1	19624.9	2	12	374.9	1271.669	...	...	43	......	43
19193.4	19168.5	2	11	356.0	1242.095	...	...	42	......	42
18683.7	18712.1	2	10	337.1	1212.522	...	...	41	......	41
18490.8	18518.8	2	10	143.8	1200	...	...	40	276.8	40.577
18228.0	18255.7	2	9	318.2	1182.948	...	...	40	......	40
17772.3	17799.3	2	8	299.3	1153.374	...	...	39	......	39
17316.6	17342.9	2	7	280.4	1123.801	...	...	38	......	38
16949.8	16975.6	2	6	350.6	1100	...	...	37	93.6	37.195
16860.9	16886.5	2	6	261.5	1094.227	...	...	37	......	37
16405.2	16430.1	2	5	242.6	1064.653	...	...	36	......	36
15949.5	15973.7	2	4	223.7	1035.080	...	...	35	......	35
15493.8	15517.3	2	3	204.8	1005.506	...	...	34	......	34
15409.0	15432.4	2	3	119.9	1000	...	...	33	390.6	33.814
15336.6	15060.9	2	2	185.9	975.932	...	...	33	......	33
14638.5	14660.7	2	1	223.2	950	...	...	32	59.1	32.123
14582.4	14604.5	2	1	167.0	946.358	...	...	32	......	32
14126.7	14148.2	2	...	148.2	916.875	...	...	31	......	31
13979.1	14000	2	...	......	907.185	...	...	30	324.2	30.676
13867.9	13889.1	1	15	326.6	900	...	...	30	207.6	30.432
13671.0	13691.8	1	15	129.3	887.211	...	...	30	......	30
13542.0	13562.5	1	15	......	878.635	...	...	29	344.1	29.717
13215.3	13235.0	1	14	10.4	857.637	...	...	29	......	29
13105.5	13125	1	14	......	850.486	...	...	28	363.9	28.759
13097.7	13117.5	1	13	430.0	850	...	...	28	356.0	28.742
12759.6	12779.0	1	13	91.5	828.064	...	...	28	......	28
12668.5	12687.5	1	13	......	822.136	...	...	27	383.8	27.800
12327.1	12345.9	1	12	95.9	800	...	...	27	24.5	27.051
12303.9	12322.6	1	12	72.6	798.490	...	...	27	......	27
12231.4	12250	1	12	......	793.787	...	...	26	403.7	26.841
11848.2	11866.2	1	11	53.7	768.916	...	...	26	......	26
11794.9	11812.5	1	11	......	765.437	...	...	25	423.6	25.883
11556.6	11574.3	1	10	199.0	750	...	...	25	173.0	25.360
11392.5	11409.8	1	10	34.8	739.343	...	...	25	......	25
11357.9	11375	1	10	......	737.087	...	...	24	443.4	24.924
10936.8	10953.4	1	9	15.9	709.769	...	...	24	......	24
10921.3	10937.5	1	9	......	708.738	...	...	23	463.3	23.966
10786.4	10802.6	1	8	302.6	700	...	...	23	321.4	23.670
10484.3	10500	1	8	......	680.388	...	...	23	3.1	23.007
10481.1	10497.0	1	7	434.5	680.195	...	...	23	......	23
10047.3	10062.5	1	7	......	652.039	...	...	22	23.0	22.048
10025.4	10040.6	1	6	415.6	650.621	...	...	22	......	22
10015.8	10031.0	1	6	406.0	650.	...	...	21	469.9	21.979
9610.7	9625	1	6	......	623.689	...	...	21	42.9	21.09
9569.7	9584.2	1	5	396.7	621.043	...	...	21	......	21
9245.2	9259.4	1	5	71.9	600	...	...	20	138.4	20.288
9173.7	9187.5	1	5	......	595.340	...	...	20	62.7	20.131
9114.0	9127.8	1	4	377.8	591.474	...	...	20	......	20
8736.7	8750	1	4	......	566.990	...	...	19	82.6	19.172
8658.3	8671.4	1	3	358.9	561.900	...	...	19	......	19
8475.1	8487.8	1	3	175.0	550	...	...	18	286.8	18.598

Weights, Old Form.					Metric Weight and Measure.	Measures, Old Form.				
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Avoirdupois.				Fluid.				Fluid-ounces and fractions.
		lb.	oz.	grains.	Gm.] [Cc.	gal.	pts.	fluid oz.	minims.	
8300.1	8312.5	1	3	......	538.641	...	...	18	102.5	18.214
8202.6	8215.1	1	2	340.1	532.327	...	...	18	......	18
7863.1	7875	1	2	......	510.291	...	...	17	122.4	17.255
7746.9	7758.7	1	1	321.2	502.753	...	...	17	......	17
7704.5	7716.2	1	1	278.7	500	...	...	16	435.3	16.907
7426.5	7437.5	1	1	......	481.942	...	...	16	142.2	16.297
7291.2	7302.3	1	...	302.3	473.179	...	...	16	......	16
6989.5	7000	1	...	......	453.592	...	...	15	162.1	15.338
6933.9	6944.6	...	15	382.1	450	...	...	15	103.8	15.216
6835.5	6845.9	...	15	283.4	443.606	...	...	15	......	15
6552.5	6562.4	...	15	......	425.248	...	...	14	182.0	14.379
6379.8	6389.5	...	14	264.5	414.082	...	...	14	......	14
6163.8	6172.9	...	14	47.9	400	...	...	13	252.3	13.526
6115.9	6125	...	14	......	396.893	...	...	13	201.8	13.421
5924.1	5933.1	...	13	245.6	384.458	...	...	13	......	13
5678.9	5687.5	...	13	......	368.544	...	...	12	221.7	12.462
5468.4	5476.7	...	12	226.7	354.884	...	...	12	......	12
5393.2	5401.3	...	12	151.3	350	...	...	11	400.7	11.835
5241.9	5250	...	12	......	340.194	...	...	11	273.1	11.570
5012.7	5020.3	...	11	207.8	325.311	...	...	11	......	11
4805.4	4812.5	...	11	......	311.845	...	...	10	261.4	10.545
4622.6	4629.7	...	10	254.7	300	...	...	10	69.2	10.144
4557.0	4563.9	...	10	188.9	295.737	...	...	10	......	10
4368.3	4375	...	10	......	283.495	...	...	9	281.3	9.586
4101.3	4107.5	...	9	170.0	266.163	...	...	9	......	9
3931.8	3937.5	...	9	......	255.146	...	...	8	301.2	8.628
3852.0	3858.1	...	8	358.1	250	...	...	8	217.7	8.453
3645.6	3651.1	...	8	151.1	236.590	...	...	8	......	8
3494.8	3500	...	8	......	226.796	...	...	7	321.0	7.669
3189.9	3194.7	...	7	132.2	207.016	...	...	7	......	7
3081.9	3086.5	...	7	24.0	200	...	...	6	366.1	6.763
3057.7	3062.5	...	7	......	198.447	...	...	6	340.9	6.710
2734.2	2738.4	...	6	113.4	177.442	...	...	6	......	6
2621.2	2625	...	6	......	170.097	...	...	5	360.8	5.752
2311.3	2314.9	...	5	127.4	150	...	...	5	34.6	5.072
2278.5	2282.0	...	5	94.5	147.869	...	...	5	......	5
2184.2	2187.5	...	5	......	141.748	...	...	4	380.7	4.793
1926.2	1929.0	...	4	179.0	125	...	...	4	108.8	4.227
1822.8	1825.6	...	4	75.6	118.295	...	...	4	......	4
1747.2	1750	...	4	......	113.398	...	...	3	400.5	3.834
1540.7	1543.2	...	3	230.7	100	...	...	3	183.1	3.381
1386.7	1388.9	...	3	76.4	90	...	...	3	20.8	3.048
1367.1	1369.2	...	3	46.7	88.721	...	...	3	......	3
1310.6	1312.5	...	3	......	85.049	...	...	2	420.4	2.876
1232.7	1234.6	...	2	359.6	80	...	...	2	338.5	2.705
1155.7	1157.4	...	2	282.4	75	...	...	2	257.3	2.536
1078.6	1080.3	...	2	205.3	70	...	...	2	176.1	2.367
924.6	925.9	...	2	50.9	60	...	...	2	13.8	2.029
911.4	912.8	...	2	37.8	59.147	...	...	2	......	2
873.6	875	...	2	......	56.699	...	...	1	440.3	1.917
770.6	771.6	...	1	334.1	50	...	...	1	331.5	1.691
616.6	617.3	...	1	179.8	40	...	...	1	169.2	1.353

From 1 troy ounce to ⅛ ounce av.

Weights, Old Form.			Metric Weight and Measure.	Measures, Old Form.	
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Drachms.	Gm.] [Cc.	Fluid-drachms.	Minims.
479.3	**480**	8 = 1 ℥	31.103	8.418	504.8
477.6	478.4	7.973	**31**	8.385	503.1
474.7	475.4	7.923	30.805	**8⅓**	**500**
469.8	**470**	7⅚ = 47/48 ℥	30.455	8.238	494.3
465.2	465.9	7.765	30.190	**8⅙**	**490**
462.3	463.0	7.717	**30**	8.115	486.9
459.3	**460**	7⅔ = 23/24 ℥	29.807	8.063	483.8
455.7	456.392	7.607	29.573	**8**	**480**
449.3	**450**	7½ = 15/16 ℥	29.159	7.888	473.3
446.8	447.5	7.459	**29**	7.845	470.7
446.1	446.9	7.449	28.958	**7⅚**	**470**
439.3	**440**	7⅓ = 11/12 ℥	28.512	7.713	462.8
436.8	437.5	1 ℥ av.	28.350	7.668	460.1
436.7	437.4	7.290	28.341	**7⅔**	**460**
431.4	432.1	7.202	**28**	7.575	454.5
429.3	**430**	7⅙ = 43/48 ℥	27.864	7.537	452.2
427.2	427.9	7.132	27.725	**7½**	**450**
419.4	**420**	7 = ⅞ ℥	27.216	7.362	441.7
417.7	418.3	6.972	27.109	**7⅓**	**440**
416.1	416.7	6.945	**27**	7.303	438.2
409.4	**410**	6⅚ = 41/48 ℥	26.568	7.187	431.2
408.3	408.9	6.815	26.493	**7⅙**	**430**
400.6	401.2	6.687	**26**	7.033	422.0
399.4	**400**	6⅔ = ⅚ ℥	25.920	7.012	420.7
398.7	399.3	6.655	25.877	**7**	**420**
389.4	**390**	6½ = 13/16 ℥	25.271	6.837	410.2
389.2	389.8	6.497	25.261	**6⅚**	**410**
385.2	385.8	6.430	**25**	6.762	405.8
379.7	380.3	6.338	24.645	**6⅔**	**400**
379.4	**380**	6⅓ = 19/24 ℥	24.624	6.662	399.7
370.2	370.8	6.180	24.029	**6½**	**390**
369.8	370.4	6.173	**24**	6.492	389.5
369.4	**370**	6⅙ = 37/48 ℥	23.976	6.485	389.1
360.8	361.3	6.022	23.413	**6⅓**	**380**
359.5	**360**	6 = ¾ ℥	23.328	6.310	378.6
354.4	354.9	5.915	**23**	6.222	373.3
351.3	351.8	5.863	22.796	**6⅙**	**370**
349.5	**350**	5⅚ = 35/48 ℥	22.680	6.135	368.1
341.8	342.3	5.705	22.180	**6**	**360**
339.5	**340**	5⅔ = 17/24 ℥	22.032	5.960	357.6
339.0	339.5	5.658	**22**	5.952	357.1
332.3	332.8	5.547	21.563	**5⅚**	**350**
329.5	**330**	5½ = 11/16 ℥	21.384	5.785	347.1
323.6	324.1	5.401	**21**	5.680	340.8
322.8	323.3	5.388	20.948	**5⅔**	**340**
319.5	**320**	5⅓ = ⅔ ℥	20.736	5.610	336.6
313.3	313.8	5.230	20.332	**5½**	**330**
309.5	**310**	5⅙ = 31/48 ℥	20.088	5.433	326.0
308.1	308.6	5.143	**20**	5.410	324.6
303.8	304.3	5.072	19.716	**5⅓**	**320**

Weights, Old Form.			Metric Weight and Measure.	Measures, Old Form.	
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Drachms.	Gm.] [Cc.	Fluid-drachms.	Minims.
299.5	300	5 = 5/8 ℥	19.440	5.258	315.5
294.3	294.7	4.912	19.099	5 1/6	310
292.8	293.2	4.887	19	5.140	308.4
289.6	290	4 5/6 = 29/48 ℥	18.792	5.083	305.0
284.8	285.2	4.753	18.483	5	300
279.6	280	4 2/3 = 7/12 ℥	18.144	4.908	294.5
277.4	277.8	4.630	18	4.870	292.2
275.3	275.7	4.595	17.867	4 5/6	290
269.6	270	4 1/2 = 9/16 ℥	17.496	4.738	284.0
265.8	266.2	4.437	17.251	4 2/3	280
262.0	262.4	4.373	17	4.598	275.9
259.6	260	4 1/3 = 13/24 ℥	16.848	4.557	273.4
256.3	256.7	4.278	16.635	4 1/2	270
249.6	250	4 1/6 = 25/48 ℥	16.200	4.382	262.9
246.8	247.2	4.120	16.019	4 1/3	260
246.5	246.9	4.115	16	4.328	259.7
239.6	240	4 = 1/2 ℥	15.552	4.207	252.4
237.3	237.7	3.962	15.403	4 1/6	250
231.1	231.5	3.858	15	4.057	243.4
229.7	230	3 5/6 = 23/48 ℥	14.904	4.032	241.9
227.9	228.2	3.803	14.787	4	240
219.7	220	3 2/3 = 11/24 ℥	14.256	3.857	231.4
218.4	218.75	1/2 ℥ av.	14.175	3.835	230.1
218.36	218.69	3.645	14.171	3 5/6	230
215.8	216.1	3.602	14	3.787	227.2
209.7	210	3 1/2 = 7/16 ℥	13.608	3.682	220.9
208.9	209.2	3.487	13.555	3 2/3	220
200.3	200.6	3.343	13	3.517	211.0
199.7	200	3 1/3 = 5/12 ℥	12.960	3.505	210.3
199.4	199.7	3.328	12.938	3 1/2	210
189.9	190.2	3.170	12.322	3 1/3	200
189.7	190	3 1/6 = 19/48 ℥	12.312	3.330	199.8
184.9	185.2	3.087	12	3.247	194.8
180.4	180.7	3.012	11.706	3 1/6	190
179.7	180	3 = 3/8 ℥	11.664	3.155	189.3
170.8	171.1	2.852	11.090	3	180
169.7	170	2 5/6 = 17/48 ℥	11.016	2.980	178.8
169.5	169.8	2.830	11	2.975	178.5
161.4	161.6	2.693	10.474	2 5/6	170
159.8	160	2 2/3 = 1/3 ℥	10.368	2.805	168.3
154.1	154.3	2.572	10	2.705	162.3
151.9	152.1	2.535	9.858	2 2/3	160
149.8	150	2 1/2 = 5/16 ℥	9.719	2.630	157.8
142.4	142.6	2.377	9.242	2 1/2	150
139.8	140	2 1/3 = 7/24 ℥	9.072	2.453	147.2
138.7	138.9	2.315	9	2.435	146.1
132.9	133.1	2.218	8.626	2 1/3	140
129.8	130	2 1/6 = 13/48 ℥	8.424	2.278	136.7
123.3	123.5	2.058	8	2.163	129.8
119.8	120	2 = 1/4 ℥	7.776	2.103	126.2
113.9	114.1	1.902	7.393	2	120
109.8	110	1 5/6 = 11/48 ℥	7.128	1.923	115.7

Weights, Old Form.			Metric Weight and Measure.	Measures, Old Form.	
Equivalent in grains. (Temp. 15.4° C., 60° F.)	Grains.	Drachms.	Gm.] [Cc.	Fluid-drachms.	Minims.
109.2	109.375	¼℥ av.	7.087	1.917	115.0
107.8	108.0	1.800	7	1.893	113.6
99.8	100	1⅔ = 5/24 ℥	6.480	1.753	105.2
94.9	95.1	1.585	6.161	1⅔	100
92.5	92.6	1.545	6	1.623	97.4
89.0	90	1½ = 3/16 ℥	5.832	1.578	94.7
85.4	85.6	1.427	5.545	1½	90
79.9	80	1⅓ = ⅙ ℥	5.184	1.401	84.1
77.1	77.2	1.287	5	1.351	81.2
76.0	76.1	1.268	4.929	1⅓	80
69.9	70	1⅙ = 7/48 ℥	4.536	1.227	73.6
66.5	66.6	1.110	4.318	1⅙	70
61.6	61.7	1.028	4	1.082	64.9
59.9	60	1 = ⅛ ℥	3.888	1.051	63.1
56.9	57.0	.950	3.697	1	60
54.6	54.6875	⅛ ℥ av.	3.544	.955	57.5

From 50 grains to 1 minim.

Grains.	Metric Weight and Measure. Gm.] [Cc.	Minims.	Grains.	Metric Weight and Measure. Gm.] [Cc.	Minims.
50	3.240	52.6	36.1	2.341	38
49.0	3.175	51.5	36	2.333	37.9
48	3.110	50.5	35.2	2.280	37
47.5	3.081	50	35	2.268	36.8
47	3.046	49.4	34.2	2.218	36
46.6	3.019	49	34	2.203	35.8
46.3	3	48.7	33.3	2.156	35
46	2.981	48.4	33	2.138	34.7
45.6	2.957	48	32.3	2.095	34
45	2.916	47.3	32	2.074	33.7
44.7	2.896	47	31.4	2.033	33
44	2.851	46.3	31	2.009	32.6
43.7	2.834	46	30.9	2	32.5
43	2.786	45.2	30.4	1.972	32
42.8	2.773	45	30	1.944	31.6
42	2.722	44.2	29.5	1.910	31
41.8	2.711	44	29	1.879	30.5
41	2.657	43.1	28.5	1.848	30
40.9	2.649	43	28	1.814	29.4
40	2.592	42.1	27.6	1.787	29
39.9	2.588	42	27	1.750	28.4
39	2.527	41.0	26.6	1.725	28
38.98	2.526	41	26	1.685	27.3
38.03	2.464	40.0	25.7	1.664	27
38	2.462	39.97	25	1.620	26.3
37.1	2.403	39	24.7	1.602	26
37	2.398	38.9	24	1.555	25.2

Grains.	Metric Weight and Measure. Gm.] [Cc.	Minims.	Grains.	Metric Weight and Measure. Gm.] [Cc.	Minims.
23.8	1.540	25	12	0.778	12.6
23.2	1.5	24.4	11.6	0.75	12.2
23	1.490	24.2	11.4	0.739	12
22.8	1.479	24	11	0.713	11.6
22	1.426	23.1	10.5	0.678	11
21.9	1.417	23	10	0.648	10.5
21	1.361	22.1	9.5	0,616	10
20.9	1.355	22	9	0.583	9.5
20	1.296	21.03	8.6	0.555	9
19.3	1.25	20.3	8	0.518	8.4
19.02	1.232	20	7.7	0.5	8.1
19	1.231	19.97	7.6	0.493	8
18.1	1.171	19	7	0.454	7.4
18	1.166	18.9	6.7	0.431	7
17.1	1.109	18	6	0.389	6.3
17	1.102	17.9	5.7	0.370	6
16.2	1.047	17	5	0.324	5.3
16	1.037	16.8	4.8	0.308	5
15.4324	1	16.2	4	0.259	4.2
15.2	0.986	16	3.8	0.246	4
15	0.972	15.8	3	0.194	3.2
14.3	0.924	15	2.9	0.185	3
14	0.907	14.7	2	0.130	2.1
13.3	0.863	14	1.9	0.123	2
13	0.842	13.7	1	0.065	1.0517
12.4	0.801	13	0.9508	0.06161	1

From $\frac{9}{10}$ grain to $\frac{1}{100}$ grain.	
Grammes.	Grains.
0.058	$\frac{9}{10}$
0.057	$\frac{8}{9}$
0.056	$\frac{7}{8}$
0.055	$\frac{6}{7}$
0.054	$\frac{5}{6}$
0.052	$\frac{4}{5}$
0.049	$\frac{3}{4}$
0.045	$\frac{7}{10}$
0.043	$\frac{2}{3}$
0.040	$\frac{5}{8}$
0.039	$\frac{3}{5}$
0.036	$\frac{9}{16}$
0.032	$\frac{1}{2}$
0.028	$\frac{7}{16}$
0.026	$\frac{2}{5}$
0.022	$\frac{1}{3}$
0.020	$\frac{5}{16}$
0.016	$\frac{1}{4}$
0.013	$\frac{1}{5}$

Measures of length.				
Centimetres.	Inches.	Millimetres.	Inches in decimal fractions.	Inches in common fractions.
100	39.37	25.4	1	1
99.0	39	25	0.98	
96.5	38	24.5	0.96	
95	37.40	24	0.94	
93.9	37	23.8	0.94	$\frac{15}{16}$
91.4	36	23.5	0.92	
90	35.43	23	0.90	$\frac{29}{32}$
88.9	35	22.5	0.89	
86.4	34	22.2	0.87	$\frac{7}{8}$
85	33.46	22	0.87	
83.8	33	21.5	0.85	
81.3	32	21	0.83	
80	31.50	20.6	0.81	$\frac{13}{16}$
78.7	31	20.5	0.81	
76.2	30	20	0.79	
75	29.53	19.5	0.77	
73.6	29	19.1	0.75	$\frac{3}{4}$
71.1	28	19	0.75	
70	27.56	18.5	0.73	

From $\frac{3}{16}$ grain to $\frac{1}{1000}$ grain.		Measures of length.				
					Inches	
Grammes.	**Grains.**	**Centimetres.**	**Inches.**	**Millimetres.**	**in decimal fractions.**	**in common fractions.**
0.012	$\frac{3}{16}$	68.6	**27**	**18**	0.71	
0.011	$\frac{1}{6}$	66.0	**26**	17.5	0.69	$\frac{11}{16}$
0.009	$\frac{1}{7}$	**65**	25.59	**17**	0.67	
0.008	$\frac{1}{8}$	63.5	**25**	16.5	0.65	
0.007	$\frac{1}{9}$	61.0	**24**	**16**	0.63	
0.0065	$\frac{1}{10}$	**60**	23.62	15.9	0.62	$\frac{5}{8}$
0.0054	$\frac{1}{12}$	58.4	**23**	15.5	0.61	
0.0042	$\frac{1}{15}$	55.9	**22**	**15**	0.59	
0.0040	$\frac{1}{16}$	**55**	21.65	14.5	0.57	
0.0036	$\frac{1}{18}$	53.3	**21**	14.3	0.56	$\frac{9}{16}$
0.0032	$\frac{1}{20}$	50.8	**20**	**14**	0.55	
0.0027	$\frac{1}{24}$	**50**	19.69	13.5	0.53	
0.0026	$\frac{1}{25}$	48.3	**19**	**13**	0.51	
0.0022	$\frac{1}{30}$	45.7	**18**	12.7	0.50	$\frac{1}{2}$
0.0020	$\frac{1}{32}$	**45**	17.72	12.5	0.49	
0.0018	$\frac{1}{36}$	43.2	**17**	**12**	0.47	
0.0016	$\frac{1}{40}$	40.6	**16**	11.5	0.45	
0.00135	$\frac{1}{48}$	**40**	15.75	11.1	0.44	$\frac{7}{16}$
0.00129	$\frac{1}{50}$	38.1	**15**	**11**	0.43	
0.00108	$\frac{1}{60}$	35.6	**14**	10.5	0.41	
0.00101	$\frac{1}{64}$	**35**	13.78	**10**	0.39	
0.00090	$\frac{1}{72}$	33.0	**13**	9.5	0.37	$\frac{3}{8}$
0.00081	$\frac{1}{80}$	30.5	**12**	**9**	0.35	
0.00065	$\frac{1}{100}$	**30**	11.81	8.7	0.34	$\frac{11}{32}$
0.00058	$\frac{1}{112}$	27.9	**11**	8.5	0.33	
0.00054	$\frac{1}{120}$	25.4	**10**	**8**	0.31	
0.00051	$\frac{1}{128}$	**25**	9.84	7.9	0.31	$\frac{5}{16}$
0.00045	$\frac{1}{144}$	22.9	**9**	7.5	0.30	
0.00043	$\frac{1}{150}$	20.3	**8**	7.1	0.28	$\frac{9}{32}$
0.00040	$\frac{1}{160}$	**20**	7.87	**7**	0.28	
0.00036	$\frac{1}{180}$	17.8	**7**	6.5	0.26	
0.00032	$\frac{1}{200}$	15.2	**6**	6.4	0.25	$\frac{1}{4}$
0.00027	$\frac{1}{240}$	**15**	5.91	**6**	0.24	
0.00025	$\frac{1}{256}$	12.7	**5**	5.6	0.22	$\frac{7}{32}$
0.00022	$\frac{1}{300}$	10.2	**4**	5.5	0.22	
0.00020	$\frac{1}{320}$	**10**	3.94	**5**	0.20	
0.00018	$\frac{1}{360}$	**9**	3.54	4.8	0.19	$\frac{3}{16}$
0.00016	$\frac{1}{400}$	**8**	3.15	4.5	0.18	
0.000135	$\frac{1}{480}$	7.6	**3**	**4**	0.16	
0.000129	$\frac{1}{500}$	**7**	2.76	3.5	0.14	
0.000127	$\frac{1}{512}$	**6**	2.36	3.2	0.13	$\frac{1}{8}$
0.000108	$\frac{1}{600}$	5.1	**2**	**3**	0.12	
0.000101	$\frac{1}{640}$	**5**	1.97	2.5	0.10	$\frac{1}{10}$
0.000093	$\frac{1}{700}$	**4**	1.57	2.4	0.09	$\frac{3}{32}$
0.000090	$\frac{1}{720}$	**3**	1.18	**2**	0.08	
0.000081	$\frac{1}{800}$	2.54	**1**	1.6	0.06	$\frac{1}{16}$
0.000077	$\frac{1}{840}$	**2**	0.78	1.5	0.06	
0.000072	$\frac{1}{900}$	1.5	0.59	**1**	0.04	
0.000068	$\frac{1}{960}$	**1**	0.39	0.8	0.03	$\frac{1}{32}$
0.000065	$\frac{1}{1000}$	0.75	0.30	0.5	0.02	
		0.50	0.20	0.1	0.0039	
		0.25	0.10			

ORTHOGRAPHY, PRONUNCIATION, AND READING.

Orthography.—There are two methods of orthography of the metric units in use in the United States: in one of these, the original French, the units are spelled met*re*, lit*re*, gram*me;* in the other, proposed by the American Metric Bureau, the units are spelled met*er*, lit*er*, gram. It would not be appropriate in a treatise of this kind to discuss the merits of either plan, but it is unfortunate that in the U. S. Pharmacopœia of 1890 the question was not settled, the French gram*me* having been retained and met*er* and lit*er* adopted. As this compromise can only lead to confusion, the original orthography is preferred in this work, and it is used with one exception,—*i.e.*, *deca*, which is changed to *deka*, because *deca* could easily be mistaken for *deci*. In pharmacy particularly, *gramme* is to be preferred to *gram*, because in writing gram it could easily be mistaken for grain, particularly if the *i* in grain were not dotted.

Pronunciation.—Metre is pronounced mee′ter, litre lee′ter, gramme gram, not, as sometimes heard, gram′mee; centimetre should be pronounced sen′tee-mee-ter, not son′tee-mee-ter. The latter faulty pronunciation is quite common, and is due to confounding the French pronunciation with the English. Either son-tee-mā′tr (French) or sen′tee-mee-ter (English) would be correct, but to use half of the French and half of the English is obviously improper, and, as the metric system is now anglicized, the simple English pronunciation is less stilted and more appropriate.

Reading.—Some difficulty is usually experienced by those unfamiliar with the metric system in reading the quantities. In the linear measures in Pharmacy centimetres and millimetres are almost exclusively used: now, 0.05 m. would not be read five hundredths of a metre, but 5 centimetres (5 cm.); if the millimetre column contains a unit, as in 0.055 m., it is read fifty-five millimetres (55 mm.), in preference to fifty-five thousandths of a metre; or it is sometimes read five centimetres and five millimetres.

Fractions of a millimetre must be read decimally, as, 0.0555 m., fifty-five and five-tenths millimetres. In measures of capacity, cubic centimetres are exclusively used; if the quantity is less than a litre, the terms half litre, quarter litre, decilitre, centilitre, millilitre, are replaced by 500 C.c., 250 C.c., 100 C.c., 10 C.c., 1 C.c.; in aqueous liquids the cubic centimetre is considered equivalent to a gramme. In weight, when the quantity is relatively large, and in commercial transactions, the kilogramme is abbreviated to kilo, pronounced kĭl′o; when less than a kilogramme, and not less than a gramme, the quantity is read with the gramme for the unit; 2000 Gm. would be read two kilos, and 543 Gm. would be read five hundred and forty-three grammes, whilst 2543 Gm. is usually read two kilos and five hundred and forty-three grammes, although twenty-five hundred and forty-three grammes is sometimes preferred. For quantities below the gramme, decigrammes are not used, but centigrammes and milligrammes are regarded as the most convenient units: they are read in the same way as centimetres and millimetres.

Weighing and Measuring.

Among the first operations that the student is called upon to perform are the very important ones of *weighing* and *measuring*. The former process requires the use of the *balance*, or, as more frequently, but less preferably, termed, *scales*. As the successful performance of many of the processes noticed in this work depends upon a thorough knowledge of the principles of the balance, it has been selected as one of the first subjects for consideration, for this instrument in some form or other is relied upon to secure accurate quantities of the substances employed in the various operations of pharmacy.

The balance may be defined as an instrument for determining the relative weights of substances, and should be *correctly constructed, skilfully used*, and *carefully protected from injury*, if accurate results are expected.

CONSTRUCTION OF THE BALANCE.—For systematic consideration pharmaceutical balances may be classified as follows: 1. *Single beam, equal arms.* 2. *Single beam, unequal arms.* 3. *Double beam, unequal arms.* 4. *Compound lever balances.* 5. *Torsion balances.*

1. Single Beam, Equal Arm Balances.—The instrument which, notwithstanding many attempts to supplant it, still maintains its supremacy is the *single beam, equal arm balance*, which may be described as consisting of a metallic lever or beam, divided into two equal arms at the centre by a knife-edge, upon which it is supported. At exactly equal distances from this point of support, and situated in the same plane, are placed the end knife-edges: these suspend the pans which carry the substances to be weighed. A good balance should possess the following requirements:

1. *When the beam is in a horizontal position, the centre of gravity should be slightly below the point of support, or central knife-edge, and perpendicular to it.*

The relative sensibility of the balance depends upon the fulfilment of this principle, which may be roughly illustrated by forcing a pin through the centre of an oblong piece of pasteboard: if the edge of the pasteboard is touched slightly it does not oscillate at all, but revolves around the centre to a degree corresponding to the impulse representing equilibrium; if the pin be removed and inserted a very short distance above the centre, and the edge of the pasteboard touched as before, it will oscillate slowly, corresponding to a sensitive beam, the point of support being slightly above the centre of gravity; if the pin be again removed and inserted far above the centre, and the same impulse imparted to the edge, it will oscillate quickly, illustrating stable equilibrium and a beam which comes to rest quickly and is not sensitive. A more elaborate method of illustration is furnished by the use of a beam with a movable fulcrum (see Fig. 2), when the relative position of the knife-edge may be made to show, beginning at the top, 1, stable equilibrium; 2, in the centre, equilibrium; and, 3, when the lowest point is reached, unstable equilibrium, and then the slightest impulse upsets the beam.

2. *The end knife-edges must be at exactly equal distances from the*

central knife-edge; they must all be in the same plane, and the edges absolutely parallel to each other.

It is very apparent that the conditions of a good prescription balance cannot be satisfied if there is inequality in the length of the arms of the

FIG. 2.

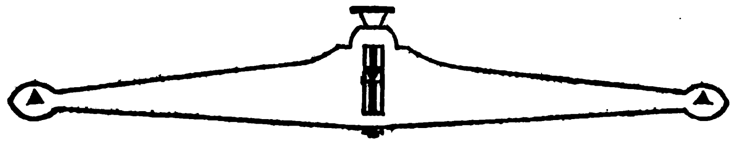
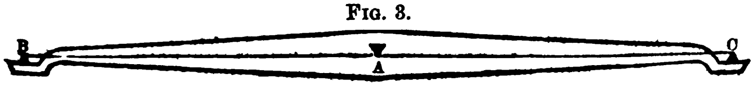


Illustration of equilibrium.

beam. In Fig. 3, BA should equal AC, otherwise unequal weights would be required to establish equilibrium, or the excess of weight of the longer arm must be subtracted at every weighing, or weighing by substitution resorted to, all manifestly impracticable. If the central knife-edge be placed either above or below a line drawn so that it connects the end knife-edges, the loading of the pans will either cause the beam to

FIG. 3.



Position of knife-edges.

cease oscillating, or diminish the sensibility in proportion to the load. If the knife-edges are not parallel, the weight of a body would not be constant upon every part of the pan, but would be greater if placed near the edge on one side, and correspondingly less at a point directly opposite.

3. *The beam should be inflexible, but as light in weight as possible, and the knife-edges in fine balances should bear upon agate planes.*

Rigidity of the beam is necessary, because any serious deflection caused by a loading of the pans would lower the end knife-edges, and thus accuracy in weighing would be impossible. The beam should not be heavier than necessary, because its sensibility (particularly when light weights were placed upon the pans) would be thereby lessened, and to diminish friction arising from the rusting of the steel knife-edges which constantly increases with the age and use of a balance, the bearings of the knife-edges should be agate planes. Formerly this condition could not be practically carried out, except in expensive balances, owing to the cost of polished agate; but since the introduction of automatic machines for grinding and polishing this very hard substance, the cost has been so reduced that not only the bearings, but the knife-edges themselves, are now made of agate and used upon fine prescription balances, and it is practical economy to employ exclusively those so mounted.

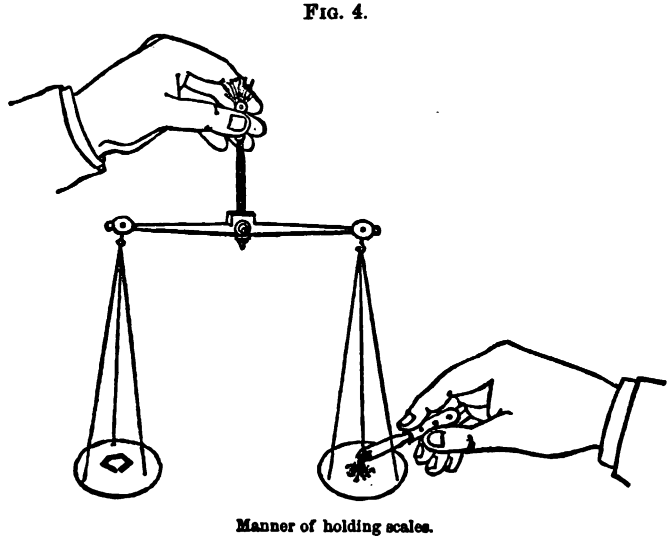
The Tests of a Balance.—Having stated the essential points in the construction of the balance, the tests, which should always be applied before accepting a balance, will now be described. The prescription balance, being one of the most delicate and important of the instruments

in use by the pharmacist, is selected for illustration. 1. A perfectly level counter or table is secured, the balance is placed in position, the beam elevated so that it is free to oscillate, and when the oscillations have ceased, the smallest weight to which the balance is sensitive is placed upon the right-hand pan,—it should at once respond to the weight; this tests its sensibility with unloaded pans. 2. Both pans are now loaded with the full weight that the balance is designed to carry, and then the smallest weight is placed upon the right-hand pan,—the oscillation, although slower than in the first test, ought to be as decided; this shows its sensibility when loaded. 3. The pans should now be loaded to half the capacity of the balance, and equilibrium perfected by adding, if necessary, a piece of tin-foil. The weights on the right-hand pan must now be exchanged for those on the left-hand pan, and *vice versa;* if equilibrium is still maintained, *the arms of the beam are equal.* 4. The pans should be moderately loaded and balanced, and one of the larger weights shifted in different positions upon the edge of one of the pans, and any variation in equilibrium carefully noted. This variation, as previously mentioned, indicates a want of parallelism in the knife-edges.

Forms of Single Beam, Equal Arm Balances.—There are good reasons for believing that this kind of balance has a very ancient origin; and at the present time it is used more frequently than any other.

Hand Scales.—The commonest form in which this principle is utilized in pharmacy is seen in the cheap hand scales now fast passing out of use; in the better qualities the beam is of steel, and the knife-edges are enclosed so as to protect them from injury. In those usually seen the

FIG. 4.



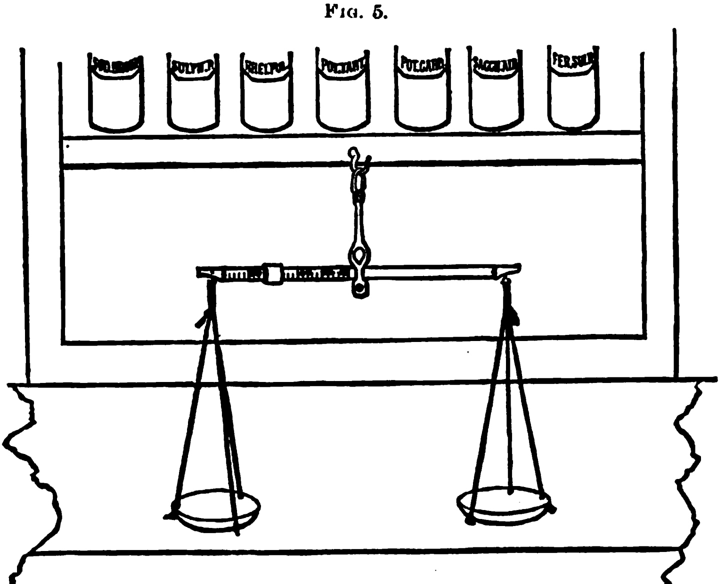
Manner of holding scales.

beam is of brass, with a steel central knife-edge, having a perforation in each end of the beam for the insertion of two wire hooks, to which are attached silken cords for supporting the pans. The manner of holding these scales is shown in Fig. 4. They are now most largely employed in

America by physicians and pharmacists having a very limited use for a balance. The silken tassel is held in the left hand, and care should always be taken *to see that the beam oscillates freely and properly* before the weight is placed upon the left-hand pan, as the hooks frequently become entangled in the cords and the adjustment is lost. The requisite quantity of the substance to be weighed is placed upon the right-hand pan, preferably with a spatula.

Alkaloids and very poisonous substances should never be weighed upon ordinary hand prescription scales, except when, by previous actual test at the time, they have been shown to be sensitive and accurate; for, although this form has been in use many years, as now found in commerce they are the most unreliable of all kinds of prescription balances, and, notwithstanding their merits of cheapness and portability, in the end they may prove (through some serious error) an expensive investment. In Fig. 5 is shown an improved form of hand scale in which a sliding weight is used; this may be suspended on a hook at the proper height as shown in the cut.

FIG. 5.



Hand scale with sliding weight.

Prescription Balances.—The advantage of substituting a rigid metallic column for the usually unsteady human arm, as a support to the beam, would seem to be apparent at a glance, for, in addition to the increased stability which is gained, both hands are left free to perform the weighing; more time can usually be devoted to secure equilibrium, and the oscillations can be more readily noticed.

A cheap form of prescription balance, called, technically, the army prescription scales (Troemner), is seen in Fig. 6; the beam, column, supports, pan, etc., are of brass, the knife-edges of steel, whilst the

drawer beneath is large enough to hold conveniently all the parts; this is a very useful feature where a balance is not in constant use, enabling the operator to set the balance at will, or keep it in the drawer protected from dust and corrosion. It may be made sensitive to the $\frac{1}{24}$ of a grain; but it soon loses this degree of delicacy, because of the rusting of the steel bearings and knife-edges. With careful handling, and by protecting it from the atmosphere by covering with a glass shade, it will remain in good order for years, and is vastly superior to the hand prescription scales.

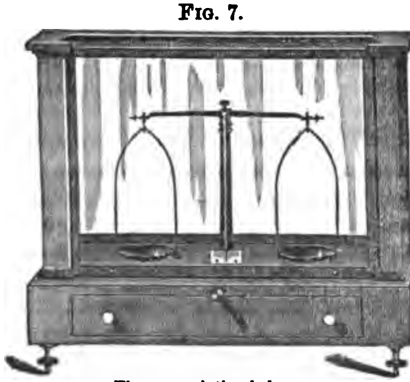
FIG. 6.

Army prescription scale.

A pharmacist who desires to make use of all the modern improvements and secure the best practical results, should have, for *economy's* sake, *two* prescription balances,—one for delicate weighings and the other for ordinary work. These need not have the most fashionable and costly *cases*, but the workmanship of the balance itself cannot be too fine, if by it are secured the absolute essentials of accuracy, sensibility, and durability.

In addition to the theoretical requirements before noted, the finest prescription balances now made by Troemner are provided with solid silver pans and gold-plated beams (see Fig. 7). As the pans are subjected to more wear and tear than any other part of the balance, it is economical to use *solid* rather than *plated* pans, for, as they have to be cleaned repeatedly, constant friction wears off the plating, and the additional cost for replating soon absorbs the difference in price. To secure the best results, when a showy appearance is not desired, a dead-black finish to the column is preferable, as the labor of polishing, with the danger to the adjustment that it involves, is dispensed with. If the supports and pans are of solid silver or nickel, and the knife-edges and the bearings of agate, a prescription balance is furnished which is durable and really cheap, because it is fully equal to the most exacting demands.

FIG. 7.

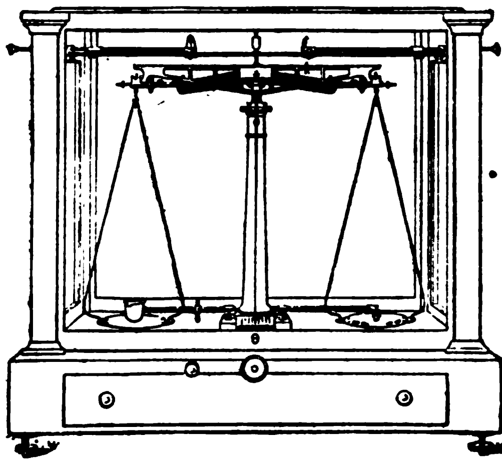


Fine prescription balance.

Analytical Balances.—The growing importance of analytical work, in connection with the quantitative tests introduced into the last revision of the U. S. Pharmacopœia, renders the possession of an analytical balance by the pharmacist very desirable. Formerly these delicate objects of mechanical skill were exclusively imported, but for twenty years American manufacturers have devoted unremitting effort to excelling in this fine work, with gratifying success. Fig. 8 shows an analytical balance of recent pattern. The open, metallic beam is made of

aluminum, the bearings and knives of agate, the pans and hangings of aluminum, all other parts being plated with gold. The ends of the stirrups are provided with hooks to suspend a body in taking its specific gravity, and a contrivance for arresting the motion of the beam and pans, together with one for elevating the beam entirely from contact with the agate planes when not in use, is provided.

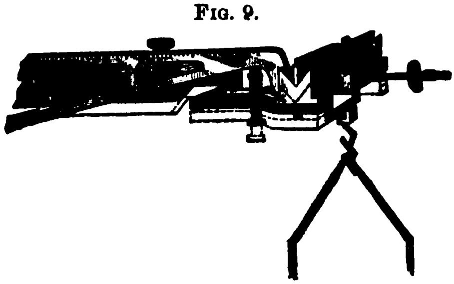
FIG. 8.



Analytical balance.

Fig. 9 shows an enlarged view of the end of the beam with the beam locked; the dotted lines show the position of the lever when the beam is permitted to oscillate. The right arm of the beam is graduated so that each division represents one-tenth of a milligramme if metric weights are used, or one-hundredth of a grain if apothecaries' weight is employed; an aluminum-wire rider is pushed along the arm by a sliding rod to any point upon the graduated beam to indicate these fractions. An index needle traverses an ivory scale fixed on the base of the column, and the most delicate oscillations may be thus measured by the needle: if, for instance, *one-tenth of a grain* on one of the pans deflects the needle *ten* divisions on the scale, each one of these divisions would then represent one-tenth of the weight on the pan, or one-hundredth of a grain. With practice, the use of this means of weighing very minute quantities can be brought to great perfection.

FIG. 9.



End of the beam of analytical balance.

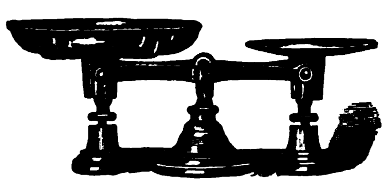
Counter Scales.—For counter and dispensing purposes, the single beam, equal arm principle was formerly exclusively used (see Fig. 10). These scales were usually made of polished brass, and answered most purposes if kept in good order, but were objectionable because the pan-supports were frequently obstructive, as they only permitted the weighing of bodies having a limited surface, and the excessive amount of polished brass-work about them required the expenditure of considerable labor to keep them bright, without any corresponding advantage. The form in which the pans are placed above the beam, thus getting rid of obstructive

pan-supports, is now greatly preferred. A cheap form is seen in Fig. 11. In these the objection to the polished brass is met by japanning the beam and weight-pan to protect them from rust; the copper or brass pan alone needs polishing, but the knife-edges and bearings require careful cleaning from time to time if their original sensitiveness is to be even approximately retained. A very convenient form of dispensing scale for smaller weights, made by Troemner, is shown in Fig. 12. This beam is provided with a parallel, graduated, nickel-plated bar, upon which a poise slides backward and forward; this is particularly useful for weighing liquids. The tare of the bottle is easily taken by the use of the sliding poise, the beam is graduated so that apothecaries' or metric weight may be used, and a projecting shelf attached to the base forms a convenient receptacle for the weights.

FIG. 10.

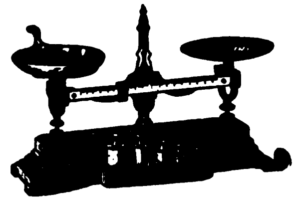
Old-style counter scales.

FIG. 11.



Common counter scales.

FIG. 12.



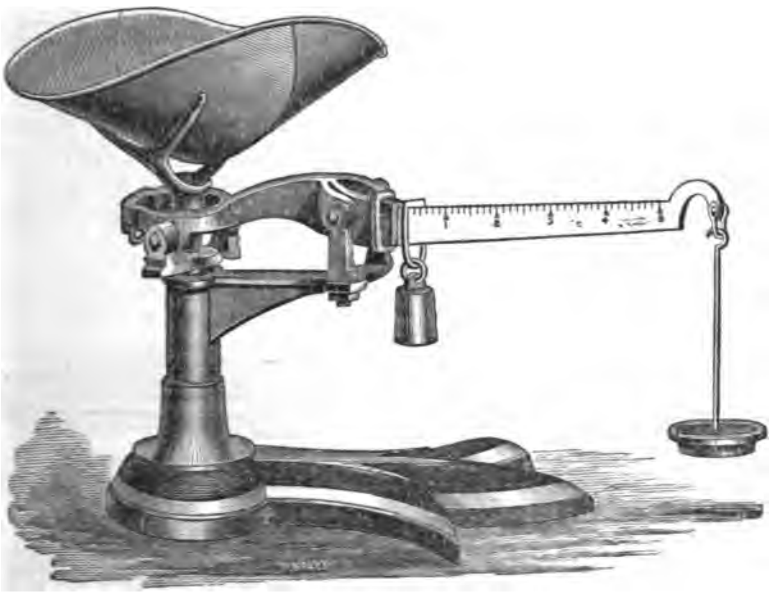
Scale with graduated parallel beam and sliding weight.

2. Forms of Single Beam, Unequal Arm Balances.—The principle upon which these very practical weighing machines are founded is best shown by referring to Fairbanks's druggists' scale (see Fig. 13), and quoting the law in physics, "*The power is to the weight or resistance in the inverse ratio of the length of the arms of the lever.*" The inequality in the length of the arms of this beam permits of the convenient use of one movable weight upon the graduated longer arm of the beam, and thus dispensing with the use of small weights, which are liable to be lost; the scoop, which is useful in weighing bulky drugs, is sometimes replaced by a flat, circular disk when bottles, etc., are to be weighed.

The principle of the graduated beam has been utilized by Fairbanks to make a very simple and convenient prescription scale, by the use of which detached weights are dispensed with (see Fig. 14). A nickel-

plated beam is suspended nearly in the centre, at one end of which a pan-support is attached, carrying a nickel-plated pan; the arm of the

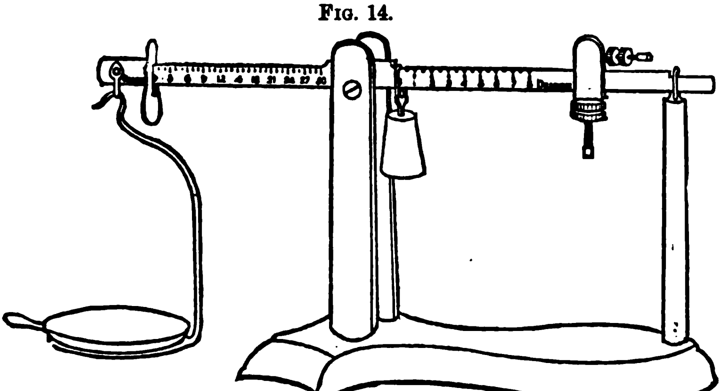
FIG. 13.



Fairbanks's druggists' scale.

beam nearest to the pan is graduated into thirty divisions and marked *grains;* a small sliding weight is used upon this arm; the other arm is graduated only about half its length, and the divisions represent *drachms.* A heavier sliding weight is used here to indicate drachms,

FIG. 14.



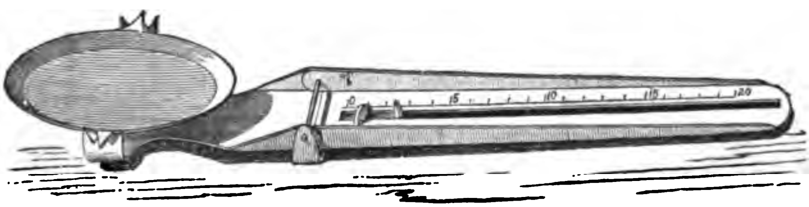
Graduated beam prescription scale.

and at the other end of the arm there is attached a weight, which is fastened to the beam by adjusting screws; this may be moved backward

or forward and set, and is for the purpose of maintaining equilibrium in case the beam should need rebalancing at any time; the end of this arm moves freely up and down in the wire loop on the upright at the end of the base. This scale is not intended for very accurate weighing, but it serves the purpose of relieving a delicate balance of a good deal of heavy wear and tear; it will, if kept in order, weigh as little as half a grain.

A very simple vest-pocket prescription scale is made by Shepard & Dudley, of New York; it is on the unequal arm principle, and is shown *full size* in Fig. 15. The principal parts are made in three pieces; the pan is detachable, the pan-support being suspended on the short rod attached to the base; the graduated beam is more than double the length

FIG. 15.



Vest-pocket prescription scale.

of the pan-support, a slot running nearly the length of this beam, and a sliding weight is pushed along in the slot. The scale is very cheap, and is intended for country physicians, who are often compelled to weigh medicines at the bedside of the patient.

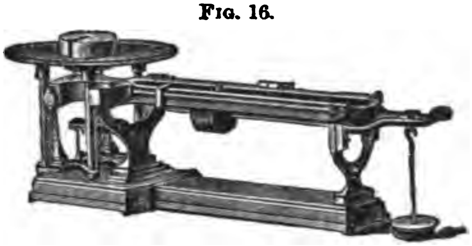
3. Double Beam, Unequal Arm Balances.—It is preferable to have a double beam scale for constant use in the laboratory, and the most convenient form is upon the same principle as Fairbanks's druggists' scale (Fig. 13), having, however, two parallel beams. This scale is particularly adapted for weighing liquids, the weight on the outside beam being used to tare the bottle or jar, whilst the other weight is left free so that it can be adjusted at once to the weight of the liquid desired. These are now to be had with the scale graduated into grammes, and are very useful in making preparations by the metric system, no loose weights being required when moderate quantities are to be weighed. (See Fig. 16.)

4. Compound Lever Balances.—The principle of the compound lever was first applied in the construction of balances by Robervahl, of Paris, about A.D. 1660. It has only been recently adopted for delicate weighings in compounding prescriptions, although the general utility of counter and platform scales constructed upon this plan has long been recognized. The principal objection to them, when compared with equal beam balances, consists in the multiplicity of points of suspension, thus necessarily increasing friction and the liability to disarrangement; but their general convenience, and some recent improvements in their construction, have brought them into favor. The principle of the Robervahl compound lever balance, with the arrangement of the levers, is shown in Troemner's glass box scale in Fig. 17.

One of the practical advantages possessed by this form of balance is the small amount of polished metal to keep in order, and, as the working parts are enclosed in a tight box of glass, wood, or marble, dust and corrosive vapors are largely excluded; as they are made to occupy as little space as possible, the pans are conveniently low and unobstructed.

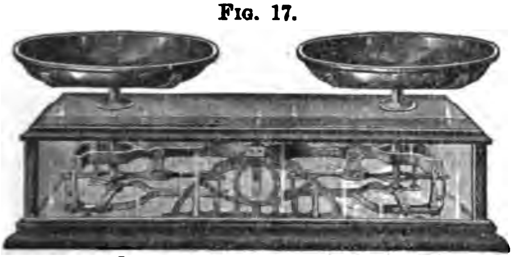
Box prescription scales, on the compound lever principle, have come into extensive use, and they are the most convenient scales for weighing moderately small quantities (see Fig. 18). Although sensitive to $\frac{1}{30}$ of a grain when new, they do not retain this delicacy long. Their strongest recommendation is the ease with which they may be cleaned and kept in order; the only polished metal liable to be affected by corrosive vapors is found in the pans, and these are nickel-plated; the marble top has a countersunk basin to keep weights in, and a hinged glass cover effectually excludes dust and vapors when the balance is not in use. If a pharmacist has a delicate, equal-beam balance for weighing alkaloids and powerful poisons (see Fig 7), and a box prescription scale for weighing ordinary quantities, he is well equipped for compounding prescriptions.

FIG. 16.



Troemner's scale for weighing liquids.

FIG. 17.



Compound lever balance in glass box.

By far the most extensive application of the compound lever and unequal arm principles has been made in the universally known platform scales, which are manufactured largely by Fairbanks and others; these are employed in weighing comparatively large quantities, and are most useful in the laboratory and warehouse. In these a platform or table is suspended by four short legs upon the ends of four levers, which are joined to a central nearly horizontal lever, which in turn is connected with a perpendicular iron rod attached to the graduated bar, suspended so that one of the arms is much longer than the other. This combination of levers is so nicely adjusted that one hundred pounds placed upon the platform may be balanced by a one-pound weight placed upon the end of the graduated bar.

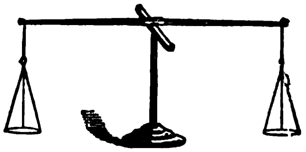
FIG. 18.

Box prescription scale.

Torsion Balances.—A simple illustration of the principle of torsion is afforded by tying a stout piece of cord to a firm support and inserting a lead-pencil in the middle of the cord between the strands, at right angles to it. If the free end of the cord is tightly stretched, and the effort is made to turn the lead-pencil over, it will be at once noticed that resistance is offered, and if the pencil is released, it at once flies back to its original position.

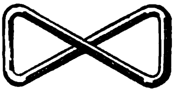
Torsion is the term applied to this method of twisting. The principle of supporting the beam of a balance upon a tightly-stretched wire, with the view of doing away with knife-edges and diminishing friction, has occupied the attention of inventors for years. One of the earliest and simplest forms in which this principle was used was that devised by Ritchie, shown in Fig. 19. A very light beam is supported exactly in the middle (at its centre of gravity) upon a wire stretched upon a horizontal bar, having its ends slightly turned up; to these the ends of the wire are fastened, the beam is firmly secured to the wire, and when it is caused to oscillate the wire is twisted according to the extent of the force applied. This balance was very delicate and impracticable, because the torsional resistance was not overcome; this had to be neutralized before the wire could be used solely as a means of supporting the beam. In 1882, Prof. Roeder and Dr. Springer contrived an ingenious torsion balance which gave promise of valuable results. Two illustrations of this original balance are shown on page 54 of the first edition of the "Practice of Pharmacy." Recent improvements have greatly increased its efficiency; the most important difficulty in applying the principle—that of torsional resistance—was overcome by the device of placing a weight just above the centre of gravity, torsional resistance having the tendency to keep the beam in a horizontal position, whilst the elevation of a weight above the centre of gravity, by its tendency to produce unstable equilibrium, see page 54, exercises an opposite effect,—that of inclining the beam to be top-heavy, and therefore to tip on either side. If now the weight be made adjustable, by mounting it upon a perpendicular screw, so that it can be raised or lowered, it is possible to arrange these opposite forces so that one exactly neutralizes the other. In this manner sensitiveness is obtained.

FIG. 19.



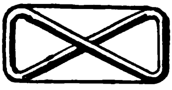
Ritchie torsion balance.

FIG. 20.



Frame.

FIG. 21.



Frame with wire.

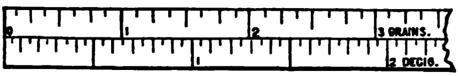
FIG. 22.

Torsion prescription balance.

In the torsion prescription balance (see Fig. 22) two beams are used, supported upon three frames, each of the latter having a flattened

metallic band stretched tightly over its edge. Fig. 20 shows one of these frames, and Fig. 21 shows a frame with the wire stretched upon it. The form of the prescription balance is that of the box scale, enclosed in a glass case, a rider beam graduated upon the upper edge from $\frac{1}{8}$ of a grain to 8 grains and on its lower edge from .5 centigramme to 5 decigrammes (see Fig. 23) furnishes a very convenient means of weighing minute quantities without having to use the small weights. The single ball elevated over the central point of support has in the later patterns been replaced by two smaller weights, one on either side of the central frame. These serve the same purpose as the single weight, and do not have the objection that the latter has, of sometimes interfering with the convenient use of the scales when large pieces of paper are placed upon the scale-pans to receive a substance to be weighed. (See Fig. 24.)

Fig. 23.



Part of the rider beam.

Fig. 24.

Torsion counter scale.

The torsion principle has also been applied to analytical balances with short arms and scales designed to carry heavier loads, as well as counter scales constructed upon the compound lever principle; balances with unequal beams and those having sliding weights upon graduated beams are now manufactured in many different patterns.

Care of the Balance.—The necessity for protecting the delicate mechanism of a balance is frequently overlooked, notwithstanding the possibility of having a fine apparatus irretrievably ruined by want of care in using or cleaning it or in protecting it whilst at rest. The position chosen for the balance or scales should be upon a level and firm counter, desk, or table, where it will be subjected to little risk of injury from dampness, dust, or corrosive vapors, and where the knife-edges will not be liable to become blunted by the jarring produced by heavy mortar-practice or other vibration.

In the finer class of balances protection is afforded by enclosing them in glass cases having sash doors in the front or at the side, and providing against injury from vibration by the use of a lever for elevating or locking the beam, so that the knife-edges are not in contact with any surface whatever. To prevent injury from jarring whilst the balance is in use, by a weight falling on the pan or other accident, the finest balances are provided with pan-supports, which break the fall and serve the additional purpose of quickly arresting the beam, thus saving time whilst weighing.

Substances which act on metals, like iodine, corrosive sublimate, etc., and those which are adhesive, like the extracts, should not be weighed directly upon the scale-pans, but upon the glass pans which are furnished

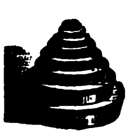
by the manufacturers, or, if these are not at hand, upon highly-glazed paper, care being taken to balance the papers before weighing the substance. In cleaning the scales, great care should be exercised; polishing powders should be used sparingly; a portion is very apt to find its way into crevices and elude detection until an attempt is made to adjust the scales, when the increased weight of one of the sides of the beam leads to its discovery. Frequent cleaning with soft leather is generally sufficient to keep a balance in good order; but if through neglect it becomes necessary to use more active measures, some simple polishing powder for the silver and brass work, with soapsuds for nickel-plate, and simple brushing for the lacquered brass, is all that is necessary.

METALLIC WEIGHTS USED IN PHARMACY.

The weights used by the pharmacist are a very important part of his outfit, and care in their selection and examination is necessary: economy of the cheese-paring order is particularly to be avoided, as the use of cheap, inaccurate weights must lead ultimately to serious consequences.

Common avoirdupois weights are usually made of iron, and are of the flat, circular form (see Fig. 25), japanned to prevent rusting; these form a pyramidal pile, and range from half an ounce to four pounds; they may be adjusted by adding to or diminishing the amount of lead which is hammered into a depression in the base of each. These weights are sometimes made of brass in this form, and sometimes of zinc: the latter, however, are brittle and unserviceable. When used for dispensing purposes, the cylindrical weights, known technically as "block weights," are preferable. If the block is made of two kinds of wood glued together, so as to avoid shrinkage, they are very desirable, particularly if each cylindrical hole in the block has been made large enough to hold easily each weight. The advantages of block weights are, that the gaps left by missing weights are readily noticed, and the greater surface of the weight is protected from the action of corrosive vapors when not in use. When the weights are nickel-plated, a more imposing appearance is produced by arranging them on an ebonized block in recesses. The disadvantage of this form is that the surfaces are not protected from oxidation, and they need cleaning more frequently. J. M. Maris & Co., of Philadelphia, supply brass avoirdupois weights having a shoulder near the top; these fit into circular openings in a hollow cast-iron frame (see Fig. 26), and by this expedient the annoyance common to ordinary blocks, caused by the shrinkage of the wood, is avoided.

FIG. 25.



Common avoirdupois weights.

FIG. 26.

Avoirdupois weights in metal frame.

Troy weights may be had either as "block weights" or "cup weights;" the latter are to be preferred, particularly if the block avoirdupois weights have already been procured, for they are then easily distinguished from each other. The cup troy weights range from quarter of an ounce to thirty-two ounces, and have many conveniences (see Fig. 27). When the outside weight is separated, it will be found to have the exact weight of all the rest; if one of the weights is missing, its absence is at once noticed in the incomplete nest; and their compact form is a great recommendation. Weights cannot well be made to occupy less space; whilst all the inside weights are protected from abrasion and corrosion.

FIG. 27.

Troy weights.

Metric weights may be procured of iron (japanned) for coarse weighing, when they are preferably hexagonal and flat in shape, to distinguish them from the ordinary round avoirdupois weights (see Fig. 28). The most useful for the pharmacist's purposes are undoubtedly the brass weights. Those made by Becker, and contained in a solid block, ranging from one centigramme to one hectogramme, as shown in Fig. 29, are very reliable and convenient.

FIG. 28.

Metric weights (iron).

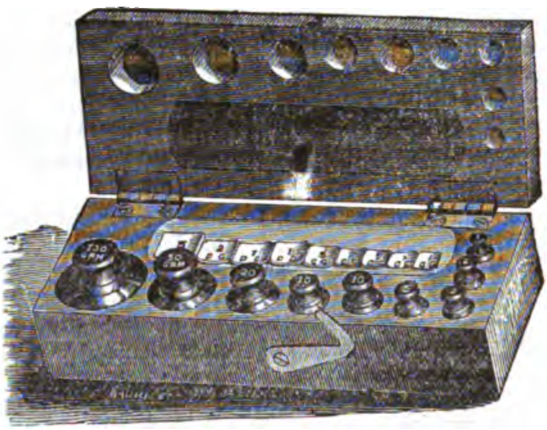
For prescription purposes, a very inexpensive yet accurate set is made by Troemner, by which as high as forty grammes may be weighed by using all the brass weights, whilst ample provision is made for weighing the fractional parts of a gramme.

For analytical purposes, metric weights are almost exclusively used; in the most complete sets the highest weight is one kilogramme, the lowest one-tenth of a milligramme; three riders for use on the graduated scale beam are provided. The weights from one gramme upward are of brass, finely lacquered; the smaller weights are made of squares of platinum-foil, curved so as to permit of being easily handled with the forceps (see Fig. 30).

Prescription Weights.—Too much care can hardly be exercised in the selection of weights to be used in compounding prescriptions. The cost of accurate weights is trifling, yet the market is flooded with weights which are disgracefully inaccurate, and it is greatly to be regretted that the latter find a ready sale. The round, flat, brass "drachm" weights, which have the denomination stamped distinctly on their face in raised characters, are most largely used: these range from ten grains to one hundred and twenty grains in weight. The old-fashioned square brass "drachm" weights are rapidly passing out of use. The brass-foil grain weights are usually inaccurate, and should not be employed, because of their liability to corrosion. Undoubtedly the best grain weights are the aluminium wire weights: these are more easily and quickly distinguished

from one another than any other form, and there is less likelihood of dangerous mistakes than from the flat weights, where the denomination is stamped upon the face, often faintly, and is liable to be obliterated

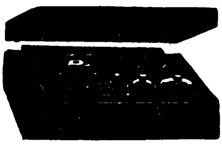
FIG. 29.



Metric weights (block).

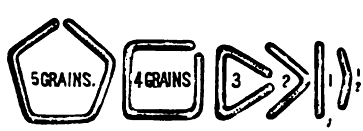
by constant use or corrosive contact. The number of sides in the wire weights at once gives the denomination (see Fig. 31). There is such a

FIG. 30.



Metric weights (analytical).

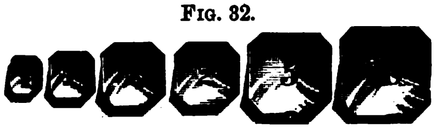
FIG. 31.



Aluminum wire weights.

difference in the shape of these weights, and they are so simply handled practically, that they should be invariably used. The aluminum grain weights, cut out of aluminum plates, are to be preferred to the flat, brass grain weights, because less liable to corrosive action. They are usually more accurately adjusted; the corners of the weights are clipped, and each weight is pressed into a curved form, so that it may be easily picked up (see Fig. 32).

FIG. 32.



Aluminum grain weights.

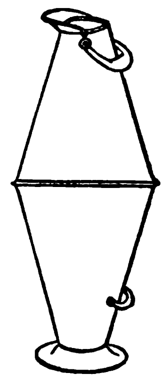
Measuring Liquids.—Tinned iron measures nearly cylindrical in shape, but slightly wider at the bottom, are generally used for measuring liquids when the quantity is over a pint. A set of these measures usually consists of four (gallon, half-gallon, quart, and pint). Those made of tinned iron, or of the enamelled sheet-iron called agate or marbleized, are greatly inferior to those made of *tinned copper*. Tinned iron measures

soon become rusty; and although a protection is afforded if enamelled, particles of the enamel become chipped off; and the exposed iron soon contaminates the liquids measured in them. Tinned copper measures cost more at first, but they are more economical, because more durable. Care must be taken to protect them from blows which will cause dents, as these may be serious enough to detract from the accuracy of the measures. Fig. 33 shows a useful combination of a measure and funnel. Cylindrical metric measures having a diameter just half their height, of tinned copper or brass, in sets of ten, including dekalitre, half-dekalitre, double litre, litre, half-litre, double decilitre, decilitre, half-decilitre, double centilitre, and centilitre, are furnished by the American Metric Bureau. An excellent measure for the laboratory, particularly where liquids are to be carried any distance, is shown in Fig. 34. It is used by Dr. E. R. Squibb, and has the merit of being less liable to error

FIG. 33.

Combined measure and funnel.

FIG. 34.



Laboratory measure.

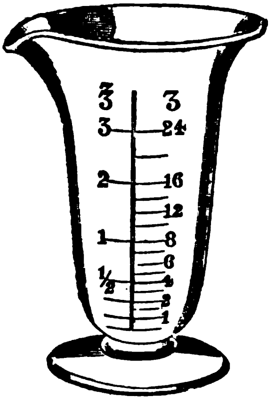
in measuring than those of ordinary shape, because of the contracted surface at the top.

Glass measures are preferred for relatively small quantities of liquids, for, although always subject to loss by fracture, they can be more accurately adjusted to indicate the measure. On account of the transparency of glass, the level of the liquid at any height may be seen through the measure, whilst porcelain or metallic measures have to be full, or nearly so, to be used.

Glass graduated measures are almost exclusively used for quantities of one pint or less, and these are of two forms,—*conical* and *cylindrical.* The conical graduate is preferred in practical work because of the greater ease with which it can be cleansed, but cylindrical measures are likely to be more accurate because of their smaller diameter: thus, if a conical graduated measure has at the f℥3 mark a diameter of 3 inches (see Figs. 35 and 36), and the cylindrical graduate a diameter at the same mark of 1 inch, it follows that a trifling error in reading off in the cylindrical graduate, either slightly above or below the line, would be increased if similarly made in the conical graduate by exactly the number of times that the surface of the conical graduate exceeds that of the cylindrical

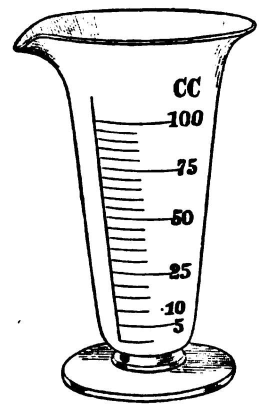
graduate at the given point (see Fig. 37). Formerly it was usual to use exclusively glass measures which had been graduated by hand; but, owing to the large quantities of imperfect graduates found in the

FIG. 35.



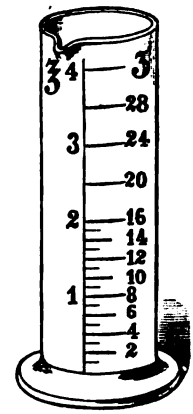
Tumbler-shaped graduate.

FIG. 36.



Metric graduate.

FIG. 37.

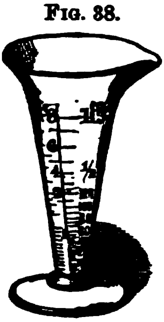


Cylindrical graduate.

market, moulded measures came into use: these, whilst deficient in the attractive brilliancy of surface characteristic of blown glass, have the substantial merit of greater accuracy. Hodgson's moulded graduated measures were the first to appear, and were largely used for a while, but they have been supplanted by Hobb's graduated measures. In Hodgson's measure the graduations are upon the outside surface of the glass, and their accuracy largely depends upon whether the plunger, which forces the melted glass into the mould, is driven down to exactly the standard depth to secure the proper thickness of glass to indicate the correct capacity: this practical point could not always be attained, owing to the wear of the mould, and occasionally the measures were imperfect. In Hobb's graduated measures this difficulty is overcome by *graduating the plunger*, and when this is done it makes no difference about the thickness of the glass, because if the plunger is correctly graduated, if the proper allowance has been made for contraction in cooling, and if a correct impression can be made upon the inside of the glass, the measure itself must be accurate, and the same result can be indefinitely repeated. An objection arises, however, to this form of graduate in measuring thick or dark-colored liquids, for then the graduations upon the inside are often completely obscured: this is sometimes remedied by correspondingly marking them upon the outside with an engraver's wheel. The introduction of the moulded graduates has had the natural effect of improving the accuracy of the blown, hand-graduated measures, and it is now unusual to see a measure like one formerly in the possession of the author, which registered 25 per cent. too much when filled to the highest graduation. If the custom of returning to the maker all graduates which prove inaccurate were universal, it would soon be impossible to find an inaccurate one: as it is, reliable graduates can always be had by paying a fair price for them.

An improvement has been made recently by graduating measures *doubly;* upon one side metric measures are marked, and upon the other ordinary fluid measures, and in addition they sometimes have two lips opposite to each other, for pouring either to the right or left, or for permitting the use of either scale. The testing of the graduation of a glass measure is effected most accurately by placing it upon a perfectly level surface and then pouring into it the proper weight of distilled water at the temperature of 15.6 C. (60° F.); the fluidounce, weighing 455.7 grains, is preferably taken as the basis. A sufficiently accurate and more ready method is to measure into the graduate from a standard burette or pipette 30 C.c. of water for a fluidounce (29.57 C.c. is the exact equivalent). The extension of the graduating mark into a circle which passes entirely around the graduate is an improvement which obviates the necessity of placing the graduate upon a level place, as the corresponding mark upon the opposite side may be seen through the glass, and the graduate easily levelled even when held in the hand. For measuring smaller quantities of liquids graduated glass tubes of much less diameter should be used, and minim pipettes are more accurate, cleanly, and convenient than the conical minim graduates which are often used, and which possess several radical faults. By referring to Fig. 38 it will be seen that the graduations on the minim measure are necessarily in the narrowest and lowest portion of a comparatively tall measure: now, if it is desired to measure ten minims of a volatile oil, to add to a pill mass, the surface which the oil must traverse when this measure is inverted over the mortar is so great that probably 20 per cent. of the oil will be left adhering to the measure. In those instances of liquid preparations where the smaller liquid is miscible with the larger quantity of diluting liquid, the minim graduate may be rinsed and this loss recovered, but inconveniences are largely overcome and greater accuracy secured by the use of the minim pipette suggested by Dr. E. R. Squibb (see Fig. 39). This in its simplest form consists of a glass tube of small calibre, with its lower extremity somewhat contracted, and having minim graduations upon its side. The pipette is used by dipping the contracted end into the liquid to be measured, and upon applying suction by the mouth at the opposite end the liquid is drawn into the pipette; the moistened tip of the right forefinger is now tightly applied to the upper end of the tube to regulate the flow of the liquid, and a sufficient quantity is allowed to flow out by slightly raising the finger until the height of the liquid corresponds to the measure desired; pressure with the forefinger at once stops the flow, and the accurately measured quantity can be transferred to the bottle, mortar, or graduate by raising the finger and allowing the liquid to flow out. These pipettes may be had of four different capacities, holding 15, 20, 30, and 60 minims, and a reference to the cut will show that a sufficient length of tube above the graduations is left to secure the operator from any risk of getting a poisonous liquid into the mouth, except through extraordinary carelessness. One of the best methods of keeping the pipette ready for use is to have it pass

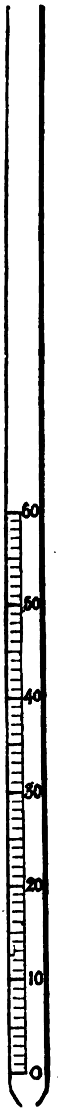
FIG. 38.



Minim measure.

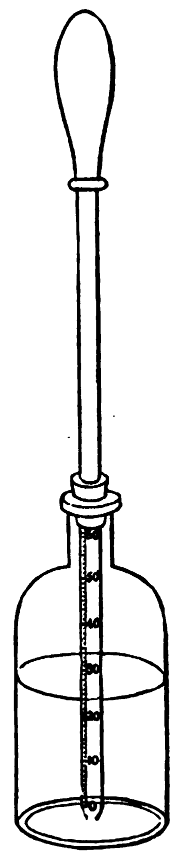
through a perforated cork which fits into a half-pint bottle containing alcohol or water (see Fig. 40), the liquid being renewed when it ceases to be clean. A rubber unperforated tube-nipple, inserted on the top of the pipette, has also been suggested to obviate the necessity of using suction with the mouth; it is used by first pushing it down over the top of the pipette until it will go no farther, then compressing the bulb and inserting the tip of the pipette into the fluid, when upon gradually relieving the pressure on the bulb the pipette commences to fill, and if not filled to the mark desired the bulb is pushed upward gently until the end is attained. In the use of tubes or glass measures of small diameter, it will be noticed that two distinct lines are visible on the surface of the liquid. This is due to the capillary attraction of the. glass, which causes the edge of the liquid to creep up the sides, and the surface becomes concave and a *meniscus* is formed; the lowest point of the lower zone is usually selected by analytical chemists as the reading point, but it is manifest that a line drawn between the upper and lower zones slightly below the middle would give the most correct reading. Fortunately, the occasions are very rare in pharmaceutical operations where a difference in the method of reading need cause concern.

FIG. 39.



Minim pipette.

FIG. 40.



Minim pipette with bottle.

In administering small quantities of liquids the very convenient *drop* is almost always used. The impression that a drop is equivalent to a minim, and that sixty drops of any fluid are equivalent to a fluidrachm, is wide-spread. This impression doubtless arose from the fact that sixty ordinary drops of *water* are about equal to a fluidrachm; but many circumstances cause variations in the relative size of drops. Thick viscous liquids, like the mucilages and the syrups, necessarily produce large drops, because the drop adheres to the surface of the glass so long as its weight does not overcome its power of adhesion, whilst bromine and chloroform, heavy, mobile liquids, having very little adhesion to the dropping surface, produce very small drops, only one-fifth the size of the drop of syrup of acacia. The shape and surface of the vessel from which the liquid is dropped also have an influence in determining the size of the drop: the greater the extent of surface for the drop to adhere to, the larger, proportionally, will be the drop. In order that this subject should have an investigation of a rather wide range, the late Stephen L. Talbot, at the author's suggestion, constructed, after many laborious trials, the following table:

Table exhibiting the Number of Drops in a Fluidrachm of different Liquids, with the Weight in Grains and in Grammes.

Name.	Drops in fʒj. (60 m.)	Weight of fʒj in gr.	Weight of fʒj in Gm.	Name.	Drops in fʒj. (60 m.)	Weight of fʒj in gr.	Weight of fʒj in Gm.
Acetum Opii	90	61	3.95	Liquor Hydrarg. Nit.	131	123	7.97
Acetum Sanguinariæ	78	55½	3.59	Liquor Iodi Comp.	63	59	3.82
Acetum Scillæ	68	57	3.69	Liquor Plumbi Subacet.	74	70	4.53
Acid. Aceticum	108	58	3.75	Liquor Potassæ	62	58	3.75
Acid. Aceticum Dilut.	68	55	3.56	Liquor Potassii Arsen.	57	55	3.56
Acid. Carbolicum	111	59	3.82	Liquor Sodæ Chloratæ	63	62	4.01
Acid. Hydrochloricum	70	65	4.21	Liquor Zinci Chloridi	89	88	5.70
Acid. Hydrochlor. Dilut.	60	56	3.62	Oleores. Aspidii	130	52	3.36
Acid. Hydrocyanicum	60	54	3.49	Oleores. Capsici	120	51	3.30
Acid. Lacticum	111	66	4.27	Oleores. Cubebæ	123	52	3.36
Acid. Nitricum	102	77	4.98	Oleum Æthereum	125	50	3.24
Acid. Nitricum Dilut.	60	58	3.62	Oleum Amygd. Amaræ	115	55	3.56
Acid. Nitrohydrochlor.	76	66	4.27	Oleum Amygd. Expres.	108	48½	3.14
Acid. Phosphoric. Dilut.	59	57	3.69	Oleum Anisi	119	54	3.49
Acid. Sulphuricum	128	101	6.54	Oleum Bergamii	130	46	2.98
Acid. Sulphur. Aromat.	146	53	3.43	Oleum Cari	132	50	3.24
Acid. Sulphuric. Dilut.	60	58½	3.79	Oleum Caryophylli	130	57	3.69
Acid. Sulphurosum	59	55	3.56	Oleum Cinnamomi	126	53½	3.46
Æther Fortior	176	39	2.52	Oleum Copaibæ	123	49½	3.20
Alcohol	146	44	2.85	Oleum Cubebæ	125	51	3.30
Alcohol Dilutum	137	49	3.17	Oleum Fœniculi	125	53	3.43
Aqua	60	55	3.56	Oleum Gaultheriæ	125	62	4.01
Aqua Ammoniæ Fortior	66	50	3.24	Oleum Juniperi	148	49	3.17
Aqua Destillata	60	53½	3.46	Oleum Lavandulæ	138	52	3.36
Balsam. Peruvianum	101	60	3.88	Oleum Limonis	129	47	3.04
Bromum	250	165	10.69	Oleum Menthæ Piperitæ	129	50	3.24
Chloroform. Purificatum	250	80	5.18	Oleum Ricini	77	51½	3.33
Copaiba	110	51	3.30	Oleum Rosæ	132	47	3.04
Creasotum	122	56½	3.66	Oleum Rosmarini	143	50	3.24
Ext. Belladon. Fluid.	156	57	3.69	Oleum Sassafras	133	58	3.75
Ext. Buchu Fluidum	150	47½	3.07	Oleum Terebinthinæ	136	45½	2.94
Ext. Cimicifugæ Fluid.	147	48	3.11	Oleum Tiglii	104	50	3.24
Ext. Cinchonæ Fluid.	138	58	3.75	Spiritus Æther. Comp.	148	45	2.91
Ext. Colchici Rad. Fl.	160	57	3.69	Spiritus Æther. Nitrosi	146	47	3.04
Ext. Colch. Sem. Fluid.	158	55	3.56	Spiritus Ammon. Arom.	142	48	3.11
Ext. Conii Fruct. Fluid.	137	61	3.95	Spiritus Camphoræ	143	47	3.04
Ext. Digitalis Fluid.	134	62	4.01	Spiritus Chloroformi	150	48	3.11
Ext. Ergotæ Fluidum	133	60	3.88	Spiritus Menthæ Pip.	142	47	3.04
Ext. Gelsemii Fluid.	149	49	3.14	Syrupus	65	72	4.66
Ext. Glycyrrhizæ Fl.	133	61	3.95	Syrupus Acaciæ	44	73	4.73
Ext. Hyoscyami Fluid.	160	59	3.82	Syrupus Ferri Iodidi	65	77	4.98
Ext. Ipecac. Fluidum	120	60	3.88	Syrupus Scillæ	75	74	4.79
Ext. Pareiræ Fluidum	140	57	3.72	Syrupus Scillæ Comp.	102	70	4.53
Ext. Rhei Fluidum	158	61	3.95	Syrupus Senegæ	106	70	4.53
Ext. Sarsap. Comp. Fl.	134	60	3.88	Tinctura Aconiti	146	46	2.98
Ext. Senegæ Fluidum	137	62	4.01	Tinctura Belladonnæ	137	53	3.43
Ext. Serpentariæ Fl.	148	47	3.07	Tinct. Benzoini Comp.	148	48	3.11
Ext. Uvæ Ursi Fluid.	137	60	3.88	Tinctura Cantharidis	131	51	3.33
Ext. Valerianæ Fluid.	150	49	3.17	Tinct. Cinchon. Comp.	140	49	3.17
Ext. Verat. Virid. Fl.	150	50	3.24	Tinctura Digitalis	128	53	3.43
Ext. Zingiberis Fluid.	142	48	3.11	Tinctura Ferri Chlorid.	150	53	3.43
Glycerinum	67	68	4.40	Tinctura Iodi	148	47	3.04
Hydrargyrum	150	760	49.24	Tinctura Nucis Vom.	140	44	2.85
Liquor Ammonii Acet.	75	56	3.62	Tinctura Opii	130	53	3.43
Liquor Acid. Arseniosi	57	55	3.56	Tinctura Opii Camph.	130	52	3.36
Liquor Arsenici et Hy-				Tinctura Opii Deodor.	110	54	3.49
drargyri Iodidi	58	55	3.56	Tinctura Valerianæ	130	52	3.36
Liquor Ferri Chloridi	71	72	4.66	Tinctura Verat. Virid.	145	46	2.98
Liquor Ferri Citratis	71	72	4.66	Tinctura Zingiberis	144	46	2.98
Liquor Ferri Nitratis	59	59	3.82	Vin. Colchici Radicis	107	55	3.56
Liquor Ferri Subsulph.	73	83	5.37	Vin. Colchici Seminis	111	54	3.49
Liquor Ferri Tersulph.	83	72	4.66	Vin. Opii	100	55	3.56

SPECIFIC GRAVITY.

A knowledge of the subject of specific gravity is necessary to the pharmacist, to enable him to identify substances or to judge of their purity, whilst the physician frequently depends upon it as an aid in diagnosing certain diseases. *Specific gravity is the weight of one body compared with the weight of an equal bulk or volume of another body selected as the standard, both bodies having the same temperature.* In ascertaining the ordinary weight of a body it is simply compared with an arbitrary standard selected by governmental authority, whilst in determining specific gravity, the body, if solid or liquid, is compared with a standard which is universal,—*i.e.*, an equal bulk of pure water expressed as 1 [1] and taken at a given temperature and atmospheric pressure. In all the methods hereafter detailed, it must be borne in mind that the main object sought for *is the weight of a bulk or volume of water equal to that of the body that we wish to take the specific gravity of.* Archimedes proved experimentally that *a body immersed in a liquid lost as much weight as its own bulk of that liquid weighed:* hence is derived the general rule for taking specific gravity,—

RULE.—**Divide the weight of the body by the weight of water displaced (loss of weight in water), the quotient will be the specific gravity.**

The taking of specific gravity will be considered as follows:

1. Solids insoluble in, but heavier than water.
2. Solids soluble in, but heavier than water.
3. Solids insoluble in, but lighter than water.
4. Solids soluble in, but lighter than water.

1. To take the specific gravity of a solid insoluble in, but heavier than water.

a. With the Balance.—It is customary to recommend a special balance for taking the specific gravity of solids, known technically as the hydrostatic balance; but a good prescription or analytical balance will answer perfectly for practical purposes. The substance, preferably in one piece, is first weighed accurately and the weight noted; a horse-hair is then tied around it with a slip-knot, and a tight loop at the other end is made, which is attached to the hook at the end of the scale-beam; a small wooden bench made for the purpose, or extemporized by taking out the bottom and one of the sides of a small wooden or stiff pasteboard box, is now arranged over the scale-pan so that it does not touch it or interfere with its free movement; upon this a small beaker or wide-mouthed jar is placed, and two-thirds filled with pure water (see Fig. 41). The horse-hair must be adjusted to such length that it will permit of the complete immersion of the substance in the water. Upon weighing the immersed substance, after freeing it from attached air-bubbles, it will be at once noticed that it has lost weight, and all that

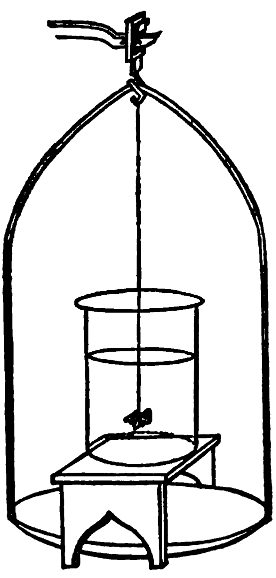
[1] The temperature usually specified in the U. S. Pharmacopœia of 1890 is 15° C. (59° F.); when not specified, it is intended to mean 15° C. (59° F.); but in many investigations, particularly those conducted in Europe, the temperature selected is that of the maximum density of water, 4° C. (39.2° F.). For practical purposes the temperature of 25° C. (77° F.) is most useful in the latitude of the United States, but it is rarely used.

remains to be done is to apply the rule, divide the weight of the body by its loss of weight in water.

For example, 805.5 grains of copper lose by immersion in water 90 grains; then 805.5 divided by 90 gives 8.95, the specific gravity of the copper. See also Nicholson's hydrometer, p. 85.

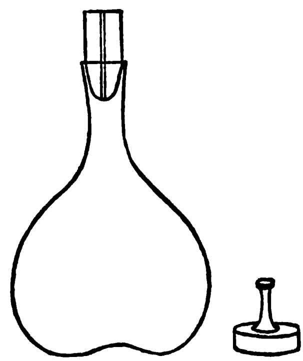
b. With the Specific Gravity Bottle.—This instrument in its most usual form is a bottle having an elongated, narrow neck, fitted with a ground-glass stopper, and holding, when filled, exactly 1000 grains of pure water at a given temperature (see Fig. 42). The reason for selecting 1000 grains for the contents is to avoid the necessity of making a calculation to obtain the specific gravity of a liquid.[1] To use the instrument for a solid substance, the previously-weighed body is dropped into the bottle, which is then filled with water at the temperature of 15° C. (59° F.), the bottle carefully dried, and, after the counterpoise (the exact weight of the empty bottle) has been placed upon the opposite scale-pan, it is weighed. To obtain the *loss of weight* in water of the substance, it is only necessary to deduct the weight of the contents of the bottle (*i.e.*, that of the water and the immersed body) from the weight of the body in air, plus that of the water which the bottle holds when full,—*i.e.*, 1000 grains; the rule is then to be applied, divide the weight of the body by its loss of weight in water.

FIG. 41.



Taking the specific gravity of a solid.

FIG. 42.



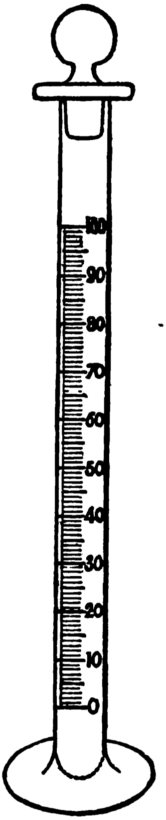
1000-grain bottle.

Example.—A piece of aluminum wire weighs 100 grains; when dropped into a 1000-grain bottle, and the bottle filled with water at the proper temperature, the weight of both is 1062 grains. As the bottle when filled with water alone held 1000 grains, and as the weight of the aluminum in air is 100 grains, both together weigh 1100 grains; hence 1100 grains, less 1062 grains, gives 38 grains, the loss of weight of the

[1] See specific gravity of liquids, p. 77.

aluminum in water. *Apply the rule,* $\frac{100}{38}=2.63$, sp. gr. The specific gravity of any insoluble powder, like calomel, litharge, etc., may be taken in exactly the same way, but care must be observed to agitate the powder with a small quantity of water in the bottle, before adding the rest, to cause the bubbles of air to escape.

FIG. 43.



Graduated specific-gravity tube.

c. With the Graduated Tube.—A graduated tube is provided in which each space indicates a grain or a gramme (C.c.) of water (or better if graduated in smaller subdivisions); the zero mark should be somewhat above the bottom of the tube, as shown in Fig. 43. Now, if water be poured into the tube exactly up to the zero mark, and a weighed solid body dropped into it, the water will rise in the tube and indicate the weight of a bulk of water equal to that of the substance; this is equivalent to the loss in water: *then apply the rule,* divide the weight of the body by its loss of weight in water. It is evident that this method cannot be as accurate as either of those above mentioned, as small differences are more clearly indicated by a good balance than by tube-reading.

d. By immersing the solid in a transparent liquid of the same density.—This method may be applied where the body is small, is not very heavy specifically, and is insoluble in the liquid. A heavy liquid is chosen, like solution of mercuric nitrate; the solid is found to float on the surface of the liquid, and water is added until the solid neither rises nor sinks, but swims indifferently: the specific gravity of the solid will of course be that of the liquid, which may be ascertained by the specific-gravity bottle (see page 77).

2. To take the specific gravity of a solid soluble in, but heavier than water.

A liquid must be selected in which the solid is insoluble, like olive oil, almond oil, benzin, or oil of turpentine: the specific gravity of the oil having been ascertained, it is used just as if it were water, the object being to find out the loss of weight that the substance suffers when immersed in the oil; this having been obtained, a simple proportion must be made, as follows: as the specific gravity of the oil is to the specific gravity of water, so is the loss of weight in the oil to the loss of weight in water: *then apply the rule,* divide the weight of the body by its loss of weight in water.

Example.—200 grains of citric acid lose by immersion in oil 115 grains; then, as

Sp. gr. of oil.		Sp. gr. of water.		Loss of weight in oil.		Loss of weight in water.	
.920	:	1.000	::	115	:	125	$\frac{200}{125}=1.6$, sp. gr. of citric acid.

It is obvious that either the balance, specific-gravity bottle, or gradu-

ated tube can be used in this case; but it is possible in some cases to coat the soluble substance with varnish and treat it then as an insoluble substance, and thus avoid the use of an oily liquid. A pill of blue-mass may be coated with shellac varnish, and then treated as an insoluble substance as in 1, *b*. The practical difficulty, however, is to secure a thin coating which shall be impervious to water.

3. To take the specific gravity of a solid insoluble in, but lighter than water.

The solution of this problem requires the aid of a heavy insoluble body, which is to be attached to the light body, so as to secure the immersion of both: it is plain that if the loss of weight in water of the heavy substance is deducted from the loss of weight in water of both the heavy and the light body, the result must give the loss of weight in water of the light body alone: then *the rule must be applied*, divide the weight of the body by its loss of weight in water.

Example.—A piece of paraffin weighs 174 grains, a piece of brass loses by immersion in water 6 grains; when the brass is attached to the paraffin, both together lose by immersion in water 206 grains; by deducting 6 grains (the loss in water of the brass) from 206 grains (the loss in water of both) the loss in water of the paraffin alone is found,—*i.e.*, 200 grains; then $\frac{174}{200}=0.870$, sp. gr. of paraffin. See also Nicholson's hydrometer, p. 85.

4. To take the specific gravity of a solid soluble in, but lighter than water.

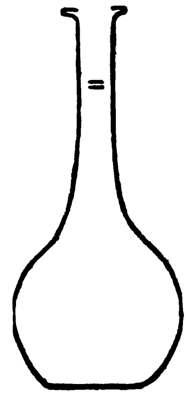
The use of the specific-gravity bottle is recommended in cases of this kind, and the process is the same as in 2: the selection of a suitable liquid lighter than the body, and in which it is insoluble, is, however, usually attended with difficulty. The proportion would be, as the specific gravity of the light liquid is to the specific gravity of water, so is the loss of weight in the light liquid to the loss of weight in water. *Then the rule must be applied*, divide the weight of the body by the loss of weight in water.

SPECIFIC GRAVITY OF LIQUIDS.

The *specific-gravity bottle* (*pycnometer* or pyknometer) is the most accurate instrument for taking the specific gravity of liquids. Fig. 42 shows an improved form: it is used as follows. The liquid to be tested is first brought to the proper temperature, 4° C. (39.2° F.), 15.6° C. (60° F.), or 15° C. (59° F.), according to the standard selected for the bottle; the bottle is filled with the liquid to the mark on the neck, dried carefully, and weighed accurately, using the counterpoise on the opposite pan. If the 1000-grain or 100-gramme bottle has been used, the weight of the liquid at once indicates the specific gravity: thus, the bottles would hold 1163 grains or 116.3 grammes of hydrochloric acid, 1250 grains or 125 grammes of glycerin, 725 grains or 72.5 grammes of ether, and 13,558 grains or 1355.8 grammes of mercury, and the specific gravity of each would be respectively 1.163, 1.250, 0.725, and 13.55, thus directly showing the relation to the specific gravity of water, 1. To

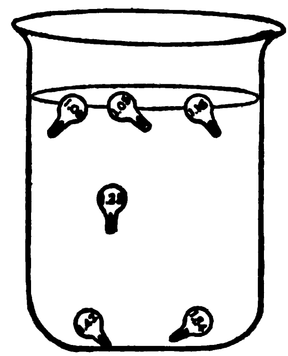
show the use of an ordinary prescription-vial in this process, one containing about a fluidounce may be taken; if it holds 455.7 grains of pure water to a mark upon the neck it will be convenient, because it will at the same time give the weight of a fluidounce of the liquid. It is evident that a bottle holding any moderate quantity may be used in the same way.

FIG. 44.



Specific-gravity bottle.

FIG. 45.



Lovi's beads.

A fluidounce bottle would hold 529.9 grains of hydrochloric acid, 569.6 grains of glycerin, 330.3 grains of ether, and 6178.5 grains of mercury, and the specific gravity would be obtained by the following proportion:

Example.—As 455.7, the number of grains of pure water that the bottle holds, is to 1.000, the specific gravity of water, so is 529.9, the number of grains of hydrochloric acid that it holds, to 1.163, the specific gravity of hydrochloric acid. 455.7 : 1.000 : : 529.9 : 1.163.

In practice, it is simply necessary to divide the number of grains of liquid that the bottle holds by 455.7 and adjust the decimal point, or multiply the weight of the liquid by 2.1945, the modulus of the bottle. The accuracy of these bottles depends entirely upon the care with which they are made and used, and it is better to scratch, with a file, two marks upon the neck of a long-necked flask, one showing the upper edge of the meniscus and the other marking the lowest point (see Fig. 44). In filling, it is a good practice, after bringing the liquid to the proper temperature, to exceed slightly the quantity indicated by the mark on the neck, and then to make a small roll of filtering-paper and neatly absorb the excess by inserting the roll in the neck so that it shall just touch the surface. The more expensive specific-gravity bottles have an accurately-fitted stopper made of thermometer-tube, and hold exactly 100 grammes, or 1000 grains, when the bottle, including the capillary tube of the stopper, is entirely full (see Fig. 42). They are not so convenient as a correctly-marked, narrow-necked bottle (see Figs. 44 and 46), nor are they practically more accurate. They have to be filled to the brim and the stopper then inserted; this causes an overflow, and the necessary wiping and the natural warmth of the hands usually expand the liquid by raising the temperature, and prevent accurate results.

A more elaborate form of apparatus for taking specific gravity is needed for some purposes; for instance, where standards are required for the liquid preparations of the Pharmacopœia or in investigations where great accuracy is necessary. Dr. Squibb has devised the pycnometer shown in Fig. 46, which is admirably adapted for taking specific gravity with the objects above mentioned.

A set of these bottles is shown in the illustration; the stopper is a tube lengthened out so that the central channel will permit the bottle to hold the volume of water at any temperature between 4° C. (39.2° F.) and 25° C. (77° F.), thus permitting any of the standards of tempera-

FIG. 46.

Squibb's specific-gravity apparatus.

ture to be used, the tube being graduated to half-millimetres, and at the top it is enlarged so as to allow room for the expansion of light liquids and to permit the bottle to be loosely closed with a cork whilst adjusting the temperature, the cork being removed during the weighing. These bottles are all used in a bath of water containing ice when the lower standard temperatures are used; a leaden collar to keep the bottle in position in the bath, a pipette for coarsely adjusting the volume of liquid, and a thermometer are also shown in Fig. 46.

It is necessary to verify the marks of the contents of the bottles from time to time, as the glass flask contracts for a year or two after it has been made. The liquid that it is designed to test is weighed into the bottle, as in the ordinary cases of taking specific gravity; the bottle is loosely corked, loaded with the leaden collar, and set in a bath of water which has been brought to the desired temperature. When the liquid

in the bottle has reached the same temperature (and this is indicated by the liquid in the tube remaining stationary, a careful watching of the rise or fall of the liquid in the graduated tube being necessary in order to determine this), the final adjustment is made and the bottle weighed.

Lovi's beads, or *specific-gravity beads*, are sometimes used for taking the specific gravity of liquids; they are especially useful in cases where a boiling liquid is to be evaporated until it has a given specific gravity, and in mixing liquids of different densities. They are balloon-shaped, hollow globes of glass, of different sizes and weights, having specific-gravity figures scratched upon their sides: these figures indicate the specific gravity of a liquid in which the beads swim indifferently; they neither rise nor sink, when not disturbed at the given temperature, if the specific gravities of the bead and liquid are the same. The illustration, Fig. 45, shows their method of use; those heavier than the liquid sinking, those lighter floating, whilst the one supported indifferently (1.25) indicates the specific gravity of the liquid. Lovi's beads may be defined as hydrometers which indicate but one specific gravity.

HYDROMETERS.

Hydrometers, sometimes called *areometers*, are floating instruments which are used to indicate the specific gravities of liquids by sinking to a depth corresponding to the densities of the liquids. Their principle of action was probably first made known by Archimedes, and depends upon the fact that when a solid body is placed in a liquid in which it is capable of floating, it sinks to a certain point, and this floating-point is reached when the body has displaced a volume of liquid exactly equal to its own weight. Thus, if a hydrometer has a specific gravity exactly three-fourths that of water, it will sink in water until exactly three-fourths of its volume is immersed; the same hydrometer would swim indifferently, like a Lovi's bead, in ether having the specific gravity of 0.750, for the obvious reason that the specific gravities of the solid and liquid are identical. Hydrometers may be divided into two classes for convenience of study: 1. Those in which the weight is constant, but the depth of immersion subject to change. 2. Those in which the depth of immersion is constant, but the weight subject to change. To the first class belong nearly all the hydrometers specially useful to pharmacists, and of these, two kinds are generally used, one for liquids heavier than water, the other for those lighter. They are known as Baumé's, Cartier's, Gay-Lussac's, Zanetti's, Twaddell's, but the best of all is the specific-gravity scale hydrometer. To the second class belong the hydrometers which are intended to sink, by the addition of weights, to a given mark on the stem, and thus displace a constant volume, like Fahrenheit's, Nicholson's, Guyton de Morveau's, etc.

1. Hydrometers in which the weight is constant, but the depth of immersion subject to change.

Baumé's Hydrometers.—This form is treated first in detail because it was the first one of its class to come into general use, having been originally described by Baumé in his "Elémens de Pharmacie." Two

instruments were used by Baumé, one termed *Pèse-Acide* or *Pèse-Sirop*, for liquids heavier than water, the other *Pèse-Esprit*, for liquids lighter than water. This hydrometer, as now made, consists of a glass tube loaded at the bottom with mercury or small shot, having a bulb blown in it just above the loaded end. A simple cylindrical tube (see Fig. 47), loaded so as to cause it to assume an upright position in a liquid, may be used as a hydrometer: the only advantage gained in expanding the lower portion into bulbs is one of convenience, that of increasing the volume of the hydrometer and thus permitting the use of shorter instruments. The graduations upon the stem of Baumé's hydrometer are entirely arbitrary, and were made in the following manner:

FIG. 47.

Cylindrical hydrometer.

FIG. 48.

FIG. 49.

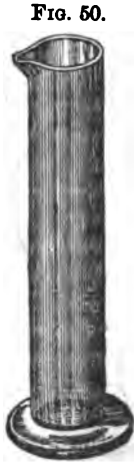
Hydrometer, double scale.

For the hydrometer to be used for *liquids heavier than water*, sufficient mercury was added to the lower bulb to cause it to sink in water to a convenient point near the top of the stem: this was marked 0. The instrument was then placed in a solution containing fifteen per cent. by weight of common salt, and the point at which it rested was marked 15: the space between these two points was divided into fifteen *equal* parts, and the scale below was extended by marking off similar spaces. *For liquids lighter than water*, the instrument was placed in a ten-per-cent. by weight solution of common salt, and loaded so that it floated at a point just above the bulb: this was marked 0. The hydrometer was then transferred to water, the point at which it rested was marked 10, the space between was divided into ten equal parts, and the scale above was extended by marking off similar spaces. The illustrations, Figs. 48, 49, were drawn from Pile's hydrometers, and show the manner of graduating the Baumé scale for both hydrometers, and, in addition, the corresponding specific-gravity figures. The Baumé hydrometer is rapidly going out of use, being replaced by a hydrometer having a graduated scale, in which the graduations represent the specific gravities.

The specific-gravity scale hydrometer, which should be used exclusively, is more

convenient and useful to the pharmacist. The graduations upon the stem are not arbitrarily chosen, but indicate at once the specific gravity of a liquid when floated in it. Two hydrometers are necessary, one for liquids heavier than water, and one for liquids lighter than water; for special purposes it is often desirable to have five or six hydrometers, beginning with one for very light liquids and ending with one for very heavy liquids, and if the diameter of the stem is narrow the divisions in the scale are not so close together, and thus a more accurate reading of the graduations is possible and the delicacy of the hydrometer increased. It must be borne in mind, however, that the hydrometer cannot be as accurate an instrument for taking specific gravity as the specific-gravity bottle: the adhesion of air-bubbles when in use, the liability to variation in the diameter of the stem, the inaccuracies in the scale and the difficulties of adjusting it so as to give correct readings, and the want of uniformity among the makers in fixing the reading-point, render it necessary for the pharmacist to verify each instrument and note its error before accepting it for practical use. In selecting a hydrometer with a specific-gravity scale, it should be at once noticed whether the graduated spaces are equal: if they are, it is useless to attempt to verify it, as it cannot be accurate, for the degree of the immersion varies with the specific gravity of the liquid, and "equal differences of specific gravity cannot be indicated by equal spaces on the scale, but by the differences of the reciprocals of those specific gravities, or by proportionate quantities." In the hydrometer shown in Fig. 48, the arbitrary scale of Baumé, made up of equal spaces, is shown immediately in contact with a specific-gravity scale: the spaces of the latter gradually increase in size from below upward, and the highest space is nearly four times the size of the lowest. The method of graduating this scale differs with different makers, but by the use of Clarke and Ackland's process it is possible to make a scale without using any other liquid than water if a correct table of reciprocals is employed (see Watts's Dictionary, vol. iii. p. 207). Before any hydrometer is accepted for use, it should be tested by floating it in water at the temperature indicated on the hydrometer, and, the specific gravity of several liquids having been ascertained carefully by the specific-gravity bottle, the hydrometer should be floated in the same liquids, and any deviation carefully noted. A hydrometer which registers uniformly one or two points too low or too high need not be rejected, because the error can be added or subtracted each time and the constant error marked on the box for a memorandum; but if an error of any magnitude has to be added to one part of the scale, and another subtracted from another part, it is economy to reject the instrument at once. Hydrometers are usually floated in tall, cylindrical glass jars (see Fig. 50), and it is frequently necessary to cool the liquid by placing the jar in ice-water after inserting a thermometer, and, after the temperature has been lowered to the desired point, observing the point to which the hydrometer sinks in the liquid. It is to be regretted that there is no fixed rule for a

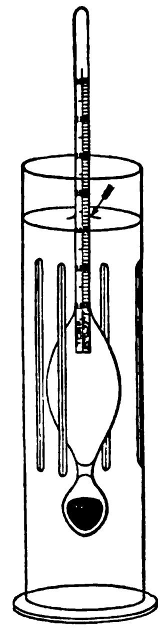
FIG. 50.



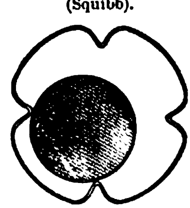
Hydrometer Jar.

reading-point; some makers adjust their instruments so as to read from a reflection in the upper part of the meniscus, others (probably the majority) prefer to take the exact level of the liquid, disregarding the meniscus altogether; this may be easily done in all cases where the liquid is transparent, or nearly so, by holding the jar containing the hydrometer at first exactly on a level with the eye, and then glancing slightly below, when a line can be traced which will exactly join the divided surface of the liquid upon either side of the stem: in case of opaque liquids an allowance can be made for the meniscus. The pharmacist should choose one or the other method and adhere to his choice, so that his verification of his own hydrometer may not vary (see Fig. 51, in which the arrow shows the point to read). It is usually best to cool the liquid below the standard temperature adopted for the hydrometer, and then, after wiping the jar, the correct higher temperature may be gradually obtained by grasping the jar with the hands and passing them up and down to warm the liquid. A hydrometer having an elongated bulb with cylindrical sides, as shown in Fig. 52, is more likely to give a false indication if permitted to touch the sides of the jar than one having an oval or globular bulb (see Fig. 51); the latter can touch the jar at only one point, and hence can move freely up and down, whilst the former may have one side touching the side of the jar for its entire length. To obviate this, Dr. Squibb suggests the use of a jar with four perpendicular indentations in it, and a hydrometer having an oval bulb (see Fig. 51). The points of contact between the urinometer bulb and the indentations in the jar are best shown in the transverse sectional view immediately below the cut of the urinometer.

FIG. 51.



Urinometer and jar (Squibb).



Sectional view.

The *urinometer* is one of the most useful special applications of the hydrometer; as its name indicates, it is used to take the specific gravity of urine; a special scale, which is easily understood, is sometimes used. The very delicate stem, which hardly permits of the use of specific-gravity figures, is divided into sixty spaces, numbered from 0 to 60; by adding 1000 to each of these numbers, and pointing off three decimal places from the right, the true specific gravity is shown. In Dr. Squibb's urinometer the specific gravity is indicated without abbreviation, the number highest on the scale being 1.000, the lowest 1.060, the intervening figures being 1.010, 1.020, 1.030, 1.040, and 1.050.

The specific gravity of urine from healthy subjects ranges from 1.010 to 1.020; that from diabetic patients has a specific gravity varying from 1.030 to 1.060.

The *saccharometer* is intended to take the specific gravity of syrups. The scale is sometimes graduated so as to indicate the percentage of sugar in solution, rarely the actual specific gravity: usually Baumé's scale

(*pèse-sirop*) is used. The *elæometer*, a very delicate instrument, is used to take the specific gravity of fixed oil. The *lactometer* is employed in detecting the adulteration of milk with water: it has a limited range, and the scale usually shows the points at which it floats in milk mixed with different proportions of water. Hydrometers are often made for taking the specific gravity of liquids, like benzin, ether, petroleum, vinegar, wine, beer, solutions of silver nitrate, sea-water, etc.; probably the most useful to the pharmacist of all of those having special applications is the one made for testing alcohol.

FIG. 52.

Alcoholmeter.

Alcoholmeters may be purchased which combine the thermometer with the hydrometer, as shown in Fig. 52, and the scale frequently has the percentage by volume of absolute alcohol marked opposite the corresponding specific gravity; when graduated so as to show the percentage by weight, they are more useful, however, on account of the adoption of the principle of parts by weight in the U. S. Pharmacopœia of 1880, thus obviating the necessity of using an alcoholmetrical table or making a calculation.

Tralles's hydrometer is an alcoholmeter having a centesimal scale: it is used by the United States government in gauging spirits, and is in general use by distillers and others. Each division of the scale corresponds to a given percentage of pure alcohol by volume in the liquor. In the United States Dispensatory, 17th Edition, p. 1816, a table is given showing the value of Tralles's degrees in specific gravity and Baumé's degrees.

Cartier's hydrometer, largely used in France, is merely a modification of Baumé's *pèse-esprit*, or hydrometer for liquids lighter than water; the zero of the scale is the same as Baumé's (10°), but the degrees are not of the same value, 32° of Baumé's scale being equal to 30° Cartier. Dorvault gives the following approximate rule for conversion: Cartier's degrees may be converted into Baumé's by subtracting 10, multiplying the remainder by .08, and adding the product to Cartier's degree.

Baumé's degrees may be converted into Cartier's by subtracting 10, multiplying the remainder by .08, and subtracting the product from Baumé's degree.

Gay-Lussac's centesimal alcoholmeter has a scale divided into 100 unequal degrees: the zero corresponds to pure water at 15° C. (59° F.) and 100° to absolute alcohol. The advantage of this method is that every intermediate degree expresses the percentage of pure alcohol by measure contained in the spirit: thus, when the instrument stands at 50° in an alcoholic liquid, it indicates that 100 measures of the liquid contain 50 of pure alcohol.

Sikes's hydrometer is used in Great Britain in the collection of the excise revenue: it is a brass instrument having a spherical bulb, with a weight at the bottom to make it float upright; the stem is divided

into twenty parts, and every other division numbered, from 0 to 10. A series of nine weights are furnished with the instrument, numbered from 10 to 90; these are to be added to the weight at the bottom to cause the hydrometer to sink, so that a reading may be had on the graduated scale; this reading added to the number on the weight employed, gives a figure which indicates the strength of the spirit by referring to a table which accompanies the instrument.

Jones's hydrometer is similar to Sikes's, but by many is regarded as an improvement on it.

Dica's hydrometer belongs to the same class.

Twaddell's hydrometer is frequently employed in England, and technical works often quote the degrees of this scale. It is used for liquids heavier than water, and is graduated so that the number of the degree, multiplied by 5 and added to 1000, gives the specific gravity: thus, 20° Twaddell indicates the specific gravity of 1100 or 1.100; 50° Twaddell, 1250 or 1.250.

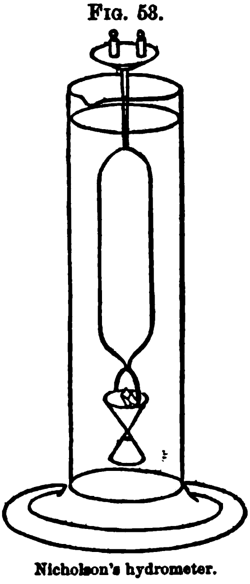
Beck's hydrometer is rarely used or referred to: in this scale 0 corresponds to the specific gravity 1.00, and 30 to that of 0.850; the scale is extended equally above and below 0. For tables, see Bayley's Chemist's Pocket-Book, p. 178.

Zanetti's hydrometers have a scale which requires the addition of a cipher to the number of the degree to show the specific gravity.

2. Hydrometers in which the depth of immersion is constant, but the weight subject to change.

Fahrenheit's hydrometer was one of the first instruments of this class to come into general use. Robert Boyle described, however, in 1675, his "New Essay Instrument," and Fahrenheit's hydrometer was very similar to it in principle; it had but a single mark on the stem, which was surmounted by a small scale-pan; weights were placed in the pan to cause the hydrometer to sink to the mark. Now, as this mark indicated the point at which the instrument would float in water at a given temperature when certain weights were placed on the pan, it follows that when it was immersed in a liquid of different specific gravity the weights would have to be changed to float the instrument to the fixed mark; the ratio which this weight bore to the weight used for water gave the specific gravity.

FIG. 53.



Nicholson's hydrometer.

Nicholson's hydrometer is similar in principle to Fahrenheit's, but is modified so that it can be used for taking the specific gravity of heavy or light solids. Fig. 53 is an illustration of one of the most convenient forms of the instrument; it is usually made of brass; there is a single mark on the stem and a scale-pan on the summit. To the lower extremity of the hydrometer two conical cups are attached; their apexes are joined so as to resemble an hour-glass; the lowest cone has several apertures at the top, to permit

of the escape of air when the instrument is immersed. The weight of the hydrometer is usually so adjusted that a 1000-grain weight is needed on the scale-pan to float it to the mark on the stem. Now, to take the specific gravity of a piece of zinc weighing less than 1000 grains, the 1000-grain weight is removed from the pan and the piece of zinc substituted for it, weights are added until the instrument floats at the mark on the stem, and it is found that an addition of 655 grains has been necessary: it is evident that the difference between 1000 and 655 gives the weight in air of the zinc, 345 grains. The zinc is now placed in the upper conical cup and weights are again placed upon the scale-pan, and it is found that the zinc has lost in weight 50 grains by immersion in water; the specific gravity is obtained by applying the well-known rule, divide the weight of the body by the loss of weight in water: $\frac{345}{50}=6.9$, sp. gr. of zinc. The lower cup is used for taking the specific gravity of bodies lighter than water, and is very convenient, the weight of the hydrometer keeping the light body submerged when the lower cup is placed over it: the specific gravity is obtained in the same manner as in the case of bodies heavier than water. One of the advantages of Nicholson's hydrometer is that it can be used in place of a balance for weighing small quantities, as shown above.

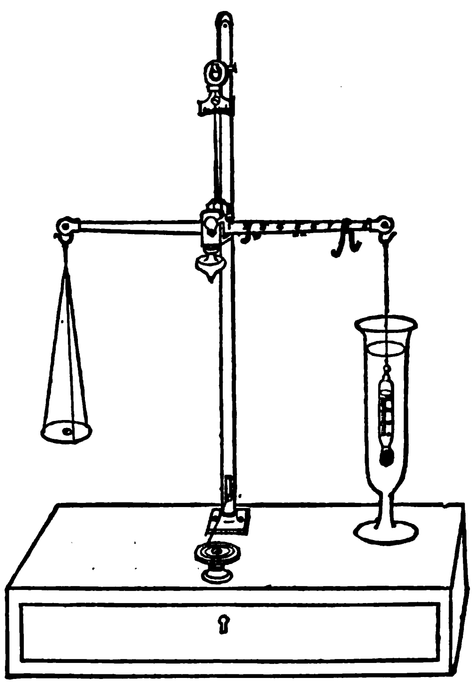
METHODS OF TAKING THE SPECIFIC GRAVITY OF SMALL QUANTITIES OF LIQUIDS.

Mohr's Apparatus.—The illustration of this apparatus (see Fig. 54) represents an improved form, yet it is quite possible for a pharmacist to construct one for himself that will answer practical purposes. It will be noticed that one end of the beam is divided into ten equal spaces, and a small glass thermometer is suspended from the extremity by a slender platinum wire, whilst the opposite scale-pan is so adjusted that it exactly counterbalances the thermometer. When the thermometer is immersed in pure water at 15° C. (59° F.), a brass wire weight is placed upon the hook at the end of the beam, and this restores the equilibrium. Now, it is apparent that if a lighter liquid, like alcohol at 15° C. (59° F.), is substituted for the water, the equilibrium cannot be maintained, and the thermometer will sink: the brass wire weight is then to be moved along the beam towards the central knife-edge until the balance is nearly restored, and this point will be found at 8, which gives the first decimal figure; still further to approach equilibrium, a wire weight, one-tenth the weight of the larger one, is pushed along the beam until it rests at the 2-mark, which gives the second decimal figure; whilst thoroughly to restore the balance the smallest weight (still one-tenth smaller) is placed at 5, and thus the third decimal figure is obtained, and the specific gravity of the alcohol is shown to be 0.825. Specific gravities of liquids heavier than water are obtained in the same way, except that the large brass-wire weight is left hanging on the hook at the end of the beam and additional weights are placed upon the beam until equilibrium is restored.

A prescription balance could be easily converted into a Mohr's appa-

ratus, and the thermometer replaced by a glass stopper suspended by a horse-hair. The thermometer in the improved form of apparatus merely serves to indicate the temperature and act as a convenient weight: in the home-made apparatus especial care must be exercised in adjusting the wire-hook weight so as exactly to immerse the stopper in water at the proper temperature.

FIG. 54.

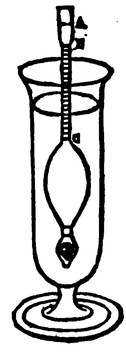


Mohr's specific-gravity apparatus.

Gannal's Method.—Gannal suggested a very convenient modification of this method of taking the specific gravity of a liquid. A piece of glass, "densimètre hydrostatique," having the shape of an olive, has a volume of 10 cubic centimetres. This is suspended from the hook at the end of the beam of a balance by a horse-hair (see Fig. 41), and weights are added to the opposite scale-pan until the balance is restored; it is then immersed in the liquid, and the metric weight required to restore the equilibrium gives the specific gravity without a calculation.

Specific-Gravity Pipette.—Grauer recommends the use of a small pipette having a fine orifice at the lower end, and at the upper end a short piece of rubber tube closed by a pinchcock; a mark is scratched on the pipette to show where a convenient weight of water rises to (1 C.c.); enough of the liquid to be tested is sucked through the tube to rise to the mark, it is then closed; the weight of the liquid indicates its specific gravity.

FIG. 55.



Rousseau's densimeter.

Rousseau's Densimeter.—This ingenious instrument is constructed upon the plan of a hydrometer (see Fig. 55). The stem from B to C is divided into 20 equal parts; the cup-shaped tube upon the summit of the stem holds exactly 1 cubic centimetre. When the densimeter is floated in water at the proper temperature, it sinks to the point C at the bottom of the stem; when the cup is filled with water to the cubic-centimetre mark, it causes the instrument to sink to the point B; this space, B C, being then divided into 20 equal parts, it follows that each division corresponds to $\frac{1}{20}$ of a gramme, or 0.05 Gm. If one cubic centimetre of oil of rose were placed in the cup, it would sink the densimeter to 17.2 divisions of the scale; then $17.2 \times 0.05 = 0.860$, sp. gr. of oil of rose.

Table giving the Specific Gravities of Official Substances arranged in the order of their densities.

Official Name.	Specific Gravity.	Weight of one Fluid-ounce in Grains.
Benzinum	0.670—0.675	305.3—307.59
Æther	0.725—0.728	330.3—331.7
Alcohol Absolutum	0.797	363.2
Spiritus Ammoniæ	0.810	369.1
Alcohol Deodoratum	0.816	371.9
Alcohol	0.820	373.6
Petrolatum Molle (60° C.—140° F.)	0.820—0.840	
Petrolatum Spissum (60° C.—140° F.)	0.820—0.850	
Spiritus Glonoini	0.826—0.832	376.4—379.1
Spiritus Ætheris Nitrosi	0.836—0.842	380.9—383.7
Oleum Aurantii Corticis	0.850	387.3
Oleum Erigerontis	0.850	387.3
Oleum Juniperi	0.850—0.890	387.3—405.5
Oleum Terebinthinæ Rectificatum	0.855—0.865	389.6—394.2
Oleum Terebinthinæ	0.855—0.870	389.6—396.4
Oleum Limonis	0.858—0.859	391.0—391.4
Terebenum	0.862	392.8
Oleum Rosæ	0.865—0.880	394.2—401.0
Amyl Nitris	0.870—0 880	396.4—401.0
Oleum Coriandri	0.870—0.885	396.4—403.2
Oleum Myristicæ	0.870—0.900	396.4—410.1
Oleum Aurantii Florum	0.875—0.890	398.7—405.5
Petrolatum Liquidum	0.875—0.945	398.7—430.6
Oleum Bergamottæ	0.880—0.885	401.0—403.2
Oleum Lavandulæ Florum	0.885—0.897	403.2—408.7
Oleum Copaibæ	0.890—0.910	405.5—414.6
Æther Aceticus	0.893—0.895	406.9—407.8
Oleum Rosmarini	0.895—0.915	407.8—416.9
Acidum Oleicum	0.900	410.1
Oleum Menthæ Piperitæ	0.900—0.920	410.1—419.2
Oleum Thymi	0.900—0.930	410.1—423.8
Aqua Ammoniæ Fortior	0 901	410.6
Spiritus Ammoniæ Aromaticus	0.905	412.4
Oleum Æthereum	0.910	414.6
Oleum Cari	0.910—0.920	414.6—419.2
Oleum Adipis	0 910—0.920	414.6—419.2
Oleum Sabinæ	0.910—0.940	414.6—428.3
Oleum Amygdalæ Expressum	0.915—0.920	416.9—419.2
Oleum Olivæ	0.915—0.918	416.9—418.3
Oleum Eucalypti	0.915—0.925	416.9—421.5
Spiritus Frumenti	0.917—0.930	417.8—423.8
Oleum Sesami	0.919—0.923	418.8—420.6
Oleum Cubebæ	0.920	419.2
Oleum Morrhuæ	0.920—0.925	419.2—421.5
Oleum Gossypii Seminis	0.920—0.930	419.2—423.8
Oleum Cajuputi	0.922—0.929	420.1—423.3
Spiritus Vini Gallici	0.925—0.941	421.5—428.8
Eucalyptol	0.930	423.8

Table giving the Specific Gravities of Official Substances arranged in the order of their densities.—(*Continued.*)

Official Name.	Specific Gravity.	Weight of one Fluid-ounce in Grains.
Oleum Lini	0.930—0.940	423.8—428.3
Oleum Hedeomæ	0.930—0.940	423.8—428.3
Oleum Menthæ Viridis	0.930—0.940	423.8—428.3
Adeps	0.932	
Alcohol Dilutum	0.936	426.5
Acidum Sulphuricum Aromaticum	0.939	427.9
Oleum Tiglii	0.940—0.960	428.3—437.4
Copaiba	0.940—0.990	428.3—451.1
Cetaceum	0.945	
Oleum Ricini	0.950—0.970	432.9—442.0
Cera Flava	0.955—0.967	
Tinctura Ferri Chloridi	0.960	437.4
Aqua Ammoniæ	0.960	437.4
Oleum Fœniculi	0.960	437.4
Cera Alba	0.965—0.975	
Oleum Picis Liquidæ	0.970	442.0
Oleum Chenopodii	0.970	442.0
Oleum Santali	0.970—0.978	442.0—445.6
Oleum Theobromatis	0.970—0.980	442.0—446.5
Oleum Myrciæ	0.975—0.990	444.3—451.1
Oleum Anisi	0.980—0.990	446.5—451.1
Vinum Rubrum	0.989—1.010	450.6—460.2
Oleum Cadinum	0.990	451.1
Vinum Album	0.990—1.010	451.1—460.2
Camphora	0.995	
Aqua Hydrogenii Dioxidi	1.006—1.012	458.4—461.1
Acidum Aceticum Dilutum	1.008	459.3
Fel Bovis	1.018—1.028	
Oleum Sinapis Volatile	1.018—1.029	463.9—468.9
Acidum Sulphurosum	1.035	
Liquor Potassæ	1.036	472.1
Oleum Pimentæ	1.045—1.055	476.2—480.7
Acidum Hypophosphorosum Dilutum	1.046	476.6
Acidum Aceticum	1.048	477.5
Liquor Ferri Nitratis	1.050	478.4
Acidum Hydrochloricum Dilutum	1.050	478.4
Liquor Sodæ Chloratæ	1.052	479.4
Oleum Cinnamomi	1.055—1.065	480.7—485.2
Acidum Phosphoricum Dilutum	1.057	481.6
Acidum Nitricum Dilutum	1.057	481.6
Acidum Aceticum Glaciale	1.058	482.1
Liquor Sodæ	1.059	482.5
Oleum Caryophylli	1.060—1.067	483.0—486.3
Oleum Amygdalæ Amaræ	1.060—1.070	483.0—487.5
Thymol	1.069	
Creosotum	1.070	487.5
Acidum Sulphuricum Dilutum	1.070	487.5
Oleum Sassafras	1.070—1.090	487.5—496.7
Acidum Hydrobromicum Dilutum	1.077	490.7

Table giving the Specific Gravities of Official Substances arranged in the order of their densities.—(*Continued.*)

Official Name.	Specific Gravity.	Weight of one Fluid-ounce in Grains.
Mel (diluted with 2 parts of water)	1.100	501.2
Balsamum Peruvianum	1.135—1.150	517.2—524.0
Liquor Ferri Acetatis	1.160	528.6
Acidum Hydrochloricum	1.163	529.9
Oleum Gaultheriæ	1.175—1.185	535.4—539.9
Methyl Salicylas	1.183—1.185	539.0—539.9
Liquor Plumbi Subacetatis	1.195	544.5
Acidum Lacticum	1.213	552.7
Cambogia	1.221	556.4
Glycerinum	1.250	569.6
Liquor Ferri Citratis	1.250	569.6
Carbonei Disulphidum	1.268—1.269	577.8—578.2
Liquor Sodii Silicatis	1.300—1.400	592.4—637.9
Syrupus Acidi Hydriodici	1.313	598.2
Syrupus	1.317	600.1
Liquor Ferri Tersulphatis	1.320	601.5
Syrupus Ferri Iodidi	1.353	616.5
Mel	1.375	626.5
Liquor Ferri Chloridi	1.387	632.0
Acidum Nitricum	1.414	644.3
Chloroformum	1.490	678.9
Liquor Zinci Chloridi	1.535	699.4
Liquor Ferri Subsulphatis	1.550	706.3
Chloral (at melting-point, 58° C.—136.4° F.)	1.575	717.7
Acidum Phosphoricum	1.710	779.2
Phosphorus	1.830	
Acidum Sulphuricum	1.835	836.2
Iodoformum	2.000	
Liquor Hydrargyri Nitratis	2.100	956.9
Bromum	2.990	1362.5
Iodum	4.948	2254.8
Hydrargyrum	13.5584	6178.5

SPECIFIC VOLUME.

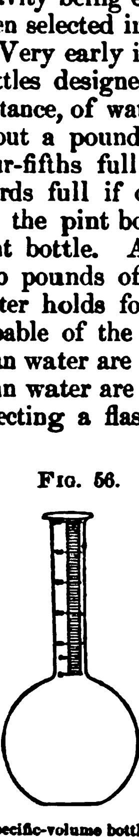
Specific volume in pharmacy may be defined *as the volume of one body compared with the volume of an equal weight of another body selected as the standard, both bodies having the same temperature.* It is directly the opposite of specific gravity. The temperature chosen is usually 15° C. (59° F.). 1. *To obtain the specific volume of a liquid.*—**Rule,** Divide the volume of the given weight of the liquid by the volume of an equal weight of water, or divide the specific gravity of water

(1.000) by the specific gravity of the liquid. Ex. 1420 Gm. of nitric acid measure 1000 C.c., and 1420 Gm. of water measure 1420 C.c.; then $\frac{1000}{1420} = .7042$, sp. vol. of nitric acid. 2. *To obtain the volume of a given weight of a liquid.*—Rule, Multiply the volume of an equal weight of water by the sp. vol. of the liquid. Ex. How many fl. oz. are there in 100 oz. av. of nitric acid? 100 oz. av. of water measure 96.01 fl. oz.; then $96.01 \times .7042 = 67.61 +$ fl. oz. of nitric acid.

Specific volume has not been used practically in this country to any extent, although there are many instructive features about it, specific gravity being employed almost exclusively, the weight standard having been selected in preference to that of volume.

Very early in the tyro's experience the fact is recognized that pound bottles designed for different liquids vary in size, a pint bottle, for instance, of water (which may be regarded as a rough standard) holding about a pound avoirdupois; the same bottle, however, would only be four-fifths full if a pound of glycerin were poured into it, and two-thirds full if chloroform were used, whilst a pound of benzin would fill the pint bottle, and there would be enough to spare to fill another pint bottle. A bottle which would hold a pound of ether would hold two pounds of chloroform, and a pint bottle holding one pound of water holds fourteen pounds of mercury. These facts are of course capable of the explanation that the specific volumes of liquids lighter than water are greater than that of water, whilst those of liquids heavier than water are less. An instructive and useful bottle may be made by selecting a flask with a long and not very narrow neck (see Fig. 56), the bulb of which would hold about 100 C.c. of water at 4° C.; if the neck would hold about 50 C.c. of the same liquid at the same temperature, and a mark was made at the 100 C.c. point and the tube graduated from 100 C.c. to 150 C.c., it would follow that in order to find the specific volume of any lighter liquid within the capacity of the bottle, all that would be necessary would be to pour into the flask 100 Gm. of such liquid at the proper temperature and read off the point to which the liquid rises. A bottle to be used for heavy liquids would have the 100 C.c. mark at the top of the neck and the C.c. graduations below decrease in value. A bottle of limited range may be constructed having the 100 C.c. mark half-way between the top of the bulb and the top of the neck.

FIG. 56.



Specific-volume bottle.

That specific volume is the antithesis of specific gravity is shown by the fact that in order to obtain the specific volume of a liquid the measure of a given weight of the liquid is divided by the measure of an equal weight of water, and (as has been shown heretofore) specific gravity is obtained by dividing the weight of a given measure of the liquid by the weight of an equal measure of water; therefore it follows that when the specific volume of a liquid is multiplied by its specific gravity the product must be 1, or the specific gravity of water.

Specific Volumes and actual Weights and Measures corresponding with given Specific Gravities (Dr. A. B. Lyons).

Specific gravity at 59° F., water at same temperature = 1.000.	Specific volume at 59° F.	Difference in specific volume corresponding with .001 in sp. gr.	Volume of 100 ounces avoirdupois in fluidounces.	Volume of 1000 grains in fluidounces.	Volume of 100 grs. in minims.	Weight of one pint in grains.	Weight of one fluidounce in grains.	Weight of one fluidounce in avoir. ounces.
.700	1.4286	.00201	137.16	3.135	150.49	5103.4	318.96	.7291
.710	1.4085	.00196	135.23	3.091	148.37	5176.3	323.52	.7395
.720	1.3889	.00190	133.35	3.048	146.31	5249.3	328.08	.7499
.730	1.3699	.00185	131.53	3.006	144.30	5322.2	332.63	.7603
.740	1.3514	.00180	129.75	2.966	142.35	5395.1	337.19	.7707
.750	1.3333	.00175	128.02	2.926	140.45	5468.0	341.75	.7811
.760	1.3158	.00171	126.33	2.888	138.61	5540.9	346.30	.7916
.770	1.2987	.00167	124.70	2.850	136.81	5613.8	350.86	.8020
.780	1.2821	.00162	123.09	2.814	135.05	5686.7	355.42	.8124
.790	1.2658	.00158	121.54	2.778	133.34	5759.6	359.97	.8228
.800	1.2500	.00155	120.02	2.743	131.68	5832.5	364.53	.8332
.805	1.2422	.00153	119.27	2.726	130.86	5868.9	366.81	.8384
.810	1.2346	.00152	118.54	2.709	130.05	5905.4	369.09	.8436
.815	1.2270	.00150	117.81	2.693	129.25	5941.9	371.37	.8488
.820	1.2195	.00148	117.09	2.676	128.46	5978.3	373.64	.8540
.825	1.2121	.00146	116.38	2.660	127.69	6014.8	375.92	.8593
.830	1.2048	.00144	115.68	2.644	126.92	6051.2	378.20	.8645
.835	1.1976	.00143	114.99	2.628	126.16	6087.7	380.48	.8697
.840	1.1905	.00141	114.30	2.613	125.41	6124.1	382.76	.8749
.845	1.1834	.00139	113.64	2.597	124.66	6160.6	385.04	.8801
.850	1.1765	.00138	112.96	2.582	123.93	6197.0	387.31	.8853
.855	1.1696	.00136	112.30	2.567	123.20	6233.5	389.59	.8905
.860	1.1628	.00134	111.64	2.552	122.49	6269.9	391.87	.8957
.865	1.1561	.00133	111.00	2.537	121.78	6306.4	394.15	.9009
.870	1.1494	.00131	110.34	2.523	121.08	6342.8	396.43	.9061
.875	1.1429	.00130	109.73	2.508	120.39	6379.3	398.71	.9113
.880	1.1364	.00128	109.11	2.494	119.70	6415.8	400.98	.9165
.885	1.1300	.00127	108.49	2.480	119.03	6452.2	403.26	.9217
.890	1.1236	.00126	107.88	2.466	118.36	6488.7	405.54	.9270
.895	1.1173	.00124	107.28	2.452	117.70	6525.1	407.82	.9322
.900	1.1111	.00123	106.68	2.438	117.05	6561.6	410.10	.9374
.905	1.1050	.00121	106.09	2.425	116.40	6598.0	412.38	.9426
.910	1.0989	.00120	105.51	2.412	115.76	6634.5	414.65	.9478
.915	1.0929	.00119	104.93	2.398	115.13	6670.9	416.93	.9530
.920	1.0870	.00118	104.36	2.385	114.51	6707.4	419.21	.9582
.925	1.0811	.00116	103.80	2.373	113.89	6743.8	421.49	.9634
.930	1.0753	.00115	103.24	2.360	113.27	6780.3	423.77	.9686
.935	1.0695	.00114	102.69	2.347	112.66	6816.7	426.05	.9738
.940	1.0638	.00113	102.14	2.335	112.06	6853.2	428.32	.9790
.945	1.0582	.00111	101.60	2.322	111.47	6889.6	430.60	.9842
.950	1.0526	.00110	101.07	2.310	110.89	6926.1	432.88	.9894
.955	1.0471	.00109	100.54	2.298	110.30	6962.5	435.16	.9946
.960	1.0417	.00108	100.15	2.286	109.73	6999.0	437.44	.9999
.965	1.0363	.00107	99.50	2.274	109.16	7035.5	439.72	1.0051
.970	1.0309	.00106	98.98	2.262	108.60	7071.9	441.99	1.0103
.975	1.0256	.00105	98.48	2.251	108.04	7108.4	444.27	1.0155
.980	1.0204	.00104	97.97	2.239	107.49	7144.8	446.55	1.0207
.985	1.0152	.00103	97.48	2.228	106.95	7181.3	448.83	1.0259
.990	1.0101	.00102	96.98	2.217	106.41	7217.7	451.11	1.0311
.995	1.0050	.00101	96.50	2.206	105.87	7254.2	453.39	1.0363
1.000	1.0000	.00099	96.01	2.195	105.34	7290.6	455.66	1.0415
1.01	.9901	.00097	95.06	2.173	104.30	7363.5	460.22	1.0519
1.02	.9804	.00095	94.13	2.152	103.28	7436.4	464.78	1.0623
1.03	.9709	.00093	93.22	2.131	102.27	7509.3	469.33	1.0728
1.04	.9615	.00091	92.32	2.110	101.29	7582.3	473.89	1.0832
1.05	.9524	.00090	91.45	2.090	100.33	7655.2	478.45	1.0936
1.06	.9434	.00088	90.58	2.070	99.38	7728.1	483.00	1.1040
1.07	.9346	.00087	89.73	2.051	98.45	7801.0	487.56	1.1144
1.08	.9259	.00085	88.90	2.032	97.54	7873.9	492.12	1.1248
1.09	.9174	.00083	88.09	2.013	96.64	7946.8	496.67	1.1353
1.10	.9091	.00082	87.29	1.995	95.76	8019.7	501.23	1.1457
1.11	.9009	.00080	86.50	1.977	94.90	8092.6	505.79	1.1561
1.12	.8929	.00079	85.73	1.960	94.00	8165.5	510.34	1.1665
1.13	.8850	.00078	84.97	1.942	93.22	8238.4	514.90	1.176[illegible]
1.14	.8772	.00076	84.22	1.925	92.40	8311.3	519.46	1.1873
1.15	.8696	.00075	83.49	1.908	91.60	8384.2	524.01	1.1977
1.16	.8621	.00074	82.77	1.892	90.81	8457.1	528.57	1.2082
1.17	.8547	.00072	82.06	1.876	90.03	8530.0	533.13	1.2186
1.18	.8475	.00071	81.37	1.860	89.27	8602.9	537.68	1.2290
1.19	.8403	.00070	80.69	1.844	88.52	8675.8	542.24	1.2394
1.20	.8333	.00069	80.01	1.829	87.78	8748.8	546.80	1.2498
1.21	.8265	.00068	79.35	1.814	87.06	8821.7	551.35	1.2602

Specific Volumes and actual Weights and Measures.—(*Continued.*)

Specific gravity at 59° F., water at same temperature = 1.000.	Specific volume at 59° F.	Difference in specific volume corresponding with .001 in sp. gr.	Volume of 100 ounces avoirdupois in fluidounces.	Volume of 1000 grains in fluidounces.	Volume of 100 grs. in minims.	Weight of one pint in grains.	Weight of one fluidounce in grains.	Weight of one fluidounce in avoir. ounces.
1.22	.8197	.00067	78.70	1.799	86.34	8894.6	555.91	1.2707
1.23	.8130	.00066	78.06	1.784	85.64	8967.5	560.47	1.2811
1.24	.8065	.00064	77.43	1.770	84.95	9040.4	565.02	1.2915
1.25	.8000	.00063	76.81	1.756	84.27	9113.3	569.58	1.3019
1.26	.7937	.00063	76.20	1.742	83.60	9186.2	574.14	1.3123
1.27	.7874	.00062	75.60	1.728	82.95	9259.1	578.69	1.3227
1.28	.7813	.00061	75.01	1.715	82.30	9332.0	583.25	1.3331
1.29	.7752	.00060	74.43	1.701	81.66	9404.9	587.81	1.3436
1.30	.7692	.00058	73.86	1.688	81.03	9477.8	592.36	1.3540
1.31	.7634	.00058	73.29	1.675	80.41	9550.7	596.92	1.3644
1.32	.7576	.00057	72.74	1.663	79.81	9623.6	601.48	1.3748
1.33	.7519	.00056	72.20	1.650	79.21	9696.5	606.03	1.3852
1.34	.7463	.00056	71.65	1.638	78.61	9769.4	610.59	1.3956
1.35	.7407	.00054	71.12	1.626	78.03	9842.3	615.15	1.4060
1.36	.7353	.00054	70.60	1.614	77.46	9915.3	619.70	1.4165
1.37	.7299	.00053	70.08	1.602	76.89	9988.2	624.26	1.4269
1.38	.7246	.00052	69.58	1.590	76.33	10061.1	628.82	1.4373
1.39	.7194	.00051	69.08	1.579	75.78	10134.0	633.37	1.4477
1.40	.7143	.00051	68.58	1.568	75.24	10206.9	637.93	1.4581
1.41	.7092	.00050	68.10	1.557	74.71	10279.8	642.49	1.4685
1.42	.7042	.00049	67.62	1.546	74.18	10352.7	647.04	1.4790
1.43	.6993	.00049	67.14	1.535	73.67	10425.6	651.60	1.4894
1.44	.6944	.00048	66.68	1.524	73.15	10498.5	656.16	1.4998
1.45	.6896	.00047	66.22	1.514	72.65	10571.4	660.71	1.5102
1.46	.6849	.00046	65.76	1.503	72.15	10644.3	665.27	1.5206
1.47	.6803	.00046	65.32	1.493	71.66	10717.2	669.83	1.5310
1.48	.6757	.00045	64.87	1.483	71.18	10790.1	674.38	1.5414
1.49	.6712	.00045	64.44	1.473	70.70	10863.0	678.94	1.5519
1.50	.6667	.00044	64.01	1.463	70.23	10935.9	683.50	1.5623
1.51	.6623	.00044	63.59	1.453	69.76	11008.8	687.95	1.5727
1.52	.6579	.00043	63.17	1.444	69.30	11081.8	692.51	1.5831
1.53	.6536	.00042	62.75	1.434	68.85	11154.7	697.07	1.5935
1.54	.6494	.00042	62.35	1.423	68.40	11227.6	701.62	1.6039
1.55	.6452	.00042	61.95	1.416	67.96	11300.5	706.18	1.6144
1.56	.6410	.00041	61.55	1.407	67.53	11373.4	710.74	1.6248
1.57	.6369	.00040	61.13	1.398	67.10	11446.3	715.39	1.6352
1.58	.6329	.00040	60.77	1.389	66.67	11519.2	719.95	1.6456
1.59	.6289	.00039	60.39	1.380	66.25	11592.1	724.51	1.6560
1.60	.6250	.00039	60.01	1.372	65.84	11665.0	729.06	1.6664
1.61	.6211	.00038	59.64	1.363	65.43	11737.9	733.62	1.6768
1.62	.6173	.00038	59.27	1.355	65.02	11810.8	738.18	1.6873
1.63	.6135	.00037	58.90	1.346	64.63	11883.7	742.73	1.6977
1.64	.6098	.00037	58.55	1.338	64.23	11956.6	747.29	1.7081
1.65	.6061	.00037	58.19	1.330	63.84	12029.5	751.85	1.7185
1.66	.6024	.00036	57.84	1.322	63.46	12102.4	756.40	1.7289
1.67	.5988	.00036	57.49	1.314	63.08	12175.3	760.96	1.7393
1.68	.5952	.00035	57.15	1.306	62.70	12248.3	768.52	1.7498
1.69	.5917	.00035	56.81	1.299	62.33	12321.2	770.07	1.7602
1.70	.5882	.00034	56.48	1.291	61.97	12394.1	774.63	1.7706
1.71	.5848	.00034	56.15	1.284	61.60	12467.0	779.19	1.7810
1.72	.5814	.00034	55.79	1.276	61.24	12539.9	783.74	1.7914
1.73	.5780	.00033	55.50	1.269	60.89	12612.8	788.30	1.8018
1.74	.5747	.00033	55.18	1.261	60.54	12685.7	792.86	1.8122
1.75	.5714	.00032	54.87	1.254	60.19	12758.6	797.41	1.8227
1.76	.5682	.00032	54.55	1.247	59.85	12831.5	801.97	1.8331
1.77	.5650	.00032	54.25	1.240	59.51	12904.4	806.53	1.8435
1.78	.5618	.00031	53.94	1.233	59.18	12977.3	810.08	1.8539
1.79	.5587	.00031	53.64	1.226	58.85	13050.2	815.64	1.8643
1.80	.5556	.00031	53.34	1.219	58.52	13123.1	820.20	1.8747
1.81	.5525	.00030	53.05	1.213	58.20	13196.0	824.75	1.8851
1.82	.5495	.00030	52.76	1.206	57.88	13268.9	829.31	1.8956
1.83	.5465	.00030	52.47	1.200	57.56	13341.8	833.87	1.9060
1.84	.5435	.00030	52.18	1.193	57.25	13414.8	838.42	1.9164
1.85	.5405		51.90	1.186	56.94	13487.7	842.98	1.9268

The third column is used for supplying figures not specified in the table. For instance, if the sp. vol. of carbon bisulphide having sp. gr. 1.272 is desired: the nearest sp. gr. is 1.270 and the corresponding sp. vol. .7874; the difference in sp. vol. corresponding with .001 in sp. gr. given in the next column is .00062. Now, 1.272 — 1.270 = 0.002; then .00062 × 2 = .00124, and .7874 — .00124 = .78616, sp. vol. of carbon bisulphide. Again, if the volume of 100 oz. av. of the same liquid is desired, column 4 gives the volume of a liquid of 1.270 sp. gr. as 75.60 fl. oz. The correction for a difference of .001 in specific gravity is found by subtracting the succeeding term from the volume corresponding with sp. gr. 1.270 (removing the decimal point one place to the left), multiplying the remainder by 2, and subtracting this from the volume corresponding with sp. gr. 1.270: thus, 75.60 — 75.01 = .59; then .059 × 2 = .118, and 75.60 — .118 = 75.482 fl. oz., the volume of 100 oz. av. carbon bisulphide.

PRACTICAL PROBLEMS AND EXERCISES

(CHAPTER I.—METROLOGY)

ILLUSTRATING THE USES OF WEIGHTS, MEASURES, SPECIFIC GRAVITY, AND SPECIFIC VOLUME.

(The answers to these questions will be found in the Appendix.)

1. If Dover's powder contains one grain of powdered ipecac, one grain of powdered opium, and eight grains of powdered sugar of milk, how much of each ingredient will be needed to make one pound (av.)?
2. What is the percentage of each ingredient in Dover's powder?
3. Add the following together, giving the answer in grains: ℥iv, ℈ij, ʒvi, 2 oz.
4. Subtract ʒx from 10 oz.
5. How much postage would be required to send this book, weighing 4 ℔. 8 oz., to Brazil, the rate being one cent for each 2 oz. or fraction?
6. How many fluidounces are there in a wine gallon?
7. How many minims are there in a pint?
8. In an Imperial pint?
9. How many grains are there in 4 oz. of water?
10. In f℥iv?
11. In ℥iv?
12. How many wine gallons are there in 40 Imperial gallons?
13. How many avoirdupois pounds in 5 wine gallons of water?
14. How many fluidrachms in an Imperial half-pint of water?
15. A physician ordered, as an application to a burn, 4 tablespoonfuls of linseed oil to be mixed with a teacupful of lime-water: what are the equivalent quantities in apothecaries' measure?
16. A traveller was ordered by his physician to take with him on a journey enough of a quinine mixture to last five weeks, taking one teaspoonful three times a day for the first week, one twice a day for the second week, one once a day for the third week, one four times during the fourth week, and one twice during the fifth week: how many fluidounces of the mixture must the apothecary compound for him?
17. A physician wants a pharmacist to make him one fluidounce of a one-per-cent. aqueous solution of cocaine hydrochlorate: how will he do it?
18. How much quinine, strychnine, and ferric phosphate would be required to make a pint of elixir of iron, quinine, and strychnine, so that each teaspoonful of finished elixir should contain $\frac{1}{64}$ of a grain of strychnine, one grain of quinine, and two grains of ferric phosphate?
19. What would an Imperial gallon of rose-water cost at the rate of 12 cents a pound (av.)?
20. A merchant offered to exchange 2 oz. of musk, valued at 4 cents per grain, for 20 Imperial gallons of orange-flower water, valued at 17 cents per pound: how much would he gain or lose?
21. Express the following: 7.5 metres in millimetres. 22. 806.23 centimetres in metres. 23. Six metres and three decimetres. 24. Twelve metres, five decimetres, four centimetres, and three millimetres. 25. Twelve thousand five hundred and forty-three millimetres.
26. Write one metre and one millimetre.
27. Read 25 Dm.
28. Read 25 dm.
29. Is the equivalent number of centimetres usually read in practice instead of using the term decimetres?
30. Read 1.2 M.
31. How does this practice resemble that in daily use in relation to our decimal system of coinage? (See No. 30.)
32. Read 4263.678 M.
33. Add 816 cm., 732 dm., and 36 mm.
34. What is the difference in length between two roots, one being 5 cm. long, the other 65 mm. long?

35. Divide 3784.128 M. by 8.
36. How many square millimetres are there in 5 square centimetres?

NOTE.—In square measure length is multiplied by width ($10 \times 10 = 100$), hence each denomination is increased or decreased by 100 instead of by 10; two decimal places are therefore required to express square measure.

37. Write eight sq. metres, thirty-six sq. decimetres.
38. Write eight sq. metres, thirty-six sq. decimetres, eight sq. centimetres.
39. Write three sq. m., three sq. dm., three sq. cm., three sq. mm.
40. Express in figures twenty sq. millimetres, twenty sq. centimetres, twenty sq. decimetres, twenty sq. metres.
41. Express in figures five hundred sq. metres, five hundred sq. decimetres, five hundred sq. millimetres.
42. How many cubic centimetres in a cubic metre?

NOTE.—In cubic measure length is multiplied by width and this by thickness: $10 \times 10 \times 10 = 1000$; so that three decimal places are required to express cubic measure.

43. Express in figures sixty-three cubic metres, sixty-three cubic decimetres, sixty-three cubic centimetres, sixty-three cubic millimetres.
44. How many cubic centimetres in a litre?
45. What metric measure of capacity corresponds with a cubic decimetre?
46. How many 100 C.c. bottles will be required to hold five litres of water?
47. A drug merchant having purchased a cubic metre of olive oil, sold from it at different times 100 litres, 87 litres, 875 C.c., 638 litres: how much had he left?
48. In making one kilo. of U. S. 1880 compound spirit of juniper, how many grammes of each ingredient would be required, the formula being as follows: Oil of juniper 10 parts, oil of caraway 1 part, oil of fennel 1 part, alcohol 8000 parts, water 1988 parts?
49. How many grains of each ingredient would be required to make one pound avoir.? (See No. 48.)
50. What percentage of an avoirdupois pound is a troy pound?
51. How much water must be added to a pint of solution of chloride of iron (containing 37.8 per cent. of anhydrous salt) to make the solution contain 10 per cent. of anhydrous salt?
52. How much of the solution of chloride of iron and how much water must be used to make a pint of solution containing 20 per cent.? (See No. 51.)
53. If moist opium containing $10\frac{1}{2}$ per cent. morphine loses 30 per cent. of its weight by drying, how much morphine per cent. will it contain when dry?
54. If one pint of a solution contains 704 grains, how much is there in each fluidrachm?
55. If one fluidrachm of a solution contains $8\frac{1}{4}$ grains, how much is there in $14\frac{1}{2}$ fluidounces?
56. If 8 fluidounces contain 240 doses, how much in each dose?
57. How many doses of $12\frac{1}{2}$ minims in $12\frac{1}{2}$ fluidounces?
58. If 96 minims of water will dissolve $7\frac{1}{8}$ grains of salt, how much will one pint dissolve?
59. How much will one pound avoirdupois dissolve? (See No. 58.)
60. How much will one pound troy dissolve? (See No. 58)
61. If liquor acidi arsenosi contains 37 grains of arsenous acid in 8 fluidounces, what fraction of a grain (exactly) is there in a fluidrachm?
62. If liquor ferri citratis (specific gravity 1.250) contains 35.5 per cent. of anhydrous salt, how much of the anhydrous salt is contained in 1 pint?
63. How much in one fluidrachm? (See No. 62.)
64. If liquor ferri nitratis contains 6 per cent. of anhydrous salt (specific gravity 1.050), how much of the salt is there in each fluidounce?
65. If liquor ferri sulphatis contains 43.7 per cent. of basic ferric sulphate (specific gravity 1.550), how much of the salt is contained in one pound avoirdupois?
66. How much in one pint? (See No. 65.)
67. How much in one fluidrachm? (See No. 65.)
68. How many minims would contain 10 grains? (See No. 65.)
69. Liquor ferri tersulphatis (specific gravity 1.320) contains 28.7 per cent. of normal ferric sulphate: how much in Oj?
70. If liquor acidi arsenosi contains 74 grains of arsenous acid in Oj, what quantity of the liquid contains one grain?
71. How many pills of 285 mg. can be made from a mass weighing 423 grammes?

72. How many cubic inches are there in one litre? (1 litre = 2.1134 pints)?
73. What part of a litre is a pint (to four decimal places)?
74. How many C.c. in a cubic foot (1 C.c. being equal to 0.061028 cubic inches)?
75. How many C.c. in a quart (1 L. = 33.815 fl. oz.)?
76. How many pints in one cubic metre (1 decilitre being equal to 3.3815 fluidounces)?
77. How many fluidrachms in a litre?
78. How many grammes in one pound avoirdupois?
79. How many grammes in a quart of a liquid of specific gravity 1.45 (1 gramme = 15.432 grains)?
80. How many milligrammes in one pound troy?
81. How many centimetres in one yard (1 mm. = .03937 inch)?
82. What is the weight in grammes of 14 cubic centimetres of mercury, its specific gravity being 13.5?
83. What is the weight in grammes of 555 cubic centimetres of sulphuric acid of specific gravity 1.84?
83*a*. What is its weight in kilogrammes? (See No. 83.)
83*b*. What is its weight in milligrammes? (See No. 83.)
84. How many metres are there in a mile (1 metre = 39.37043 inches)?
85. How many inches in 1833 centimetres?
86. How many grains of compound extract of colocynth are required to make 144 compound cathartic pills (there being 65 grs. in 50 pills)?
87. How much jalap is contained in one pound avoirdupois of compound powder of jalap (the official process ordering 35 parts in 100)?
88. What percentage must be added to 400 minims to bring the measure up to one fluidounce?
89. If 32.4 grammes be divided into 144 pills, what is the weight of each pill in grains?
90. If 46.656 grammes be divided into 144 pills, what is the weight of each pill in grammes? What in grains?
91. How much valerian must be used to make 4 pints of tincture, so that each fluidrachm shall represent 10¼ grains?
92. If a Seidlitz powder is composed of 35 grains of tartaric acid, 120 grains bicarbonate of sodium, and 40 grains Rochelle salt, how much Rochelle salt must be used to make enough Seidlitz mixture to put up one gross of boxes of Seidlitz powders, each box to contain ten doses?
93. How much bicarbonate of sodium? (See No. 92.)
94. How much tartaric acid? (See No 92.)
95. How many decilitres of oil (specific gravity .905) will a bottle hold which weighs, when full of water, 1050.5 Gm., the weight of the bottle being 610.5 Gm.?
96. If a body weighs 2.31 kilogrammes in air and 1.76 kilogrammes in water, what is its specific gravity?
97. A piece of lead weighs 148.392 pounds, and measures 12 inches long, 6 inches wide, and 5 inches thick (cubic in. water = 252. + gr.): what is its specific gravity?
98. A piece of zinc weighs in air 77.88 grains, in water 65.88 grains: what is its specific gravity?
99. What is its specific volume? (See No. 98.)
100. What is the weight of a piece of iron measuring 50 cm. long, 6 cm. wide, and 2 cm. thick, its specific gravity being 7.8?
101. What is the length of a bar of iron 8 cm. wide, 5 cm. thick, its specific gravity being 7.8 and its weight 195 kilogrammes?
102. What is the weight of a piece of iron measuring 4 decimetres long by 1 decimetre wide and 7 centimetres thick (specific gravity 7.8)?
103. One pound av. of lead shot is put into a bottle, and it is then filled with water and found to weigh 25,566 grains (the bottle when filled with water alone weighs 19,174 gr.): what is the specific gravity of the lead?
104. What is the specific gravity of a substance of which 9.7 C.c. equal 40.74 Gm.?
105. What is the specific gravity of a liquid of which one pound avoirdupois will measure one pint?
106. If 52.49 C.c. of a liquid weigh 1207 grains, what is its specific gravity, and what is the liquid (Oj = 473.11 C.c.)?
107. If 64.888 C.c. of a liquid weigh 1250 grains, what is its specific gravity, and what is the liquid?
108. What is the weight in grammes of one pint of glycerin (Oj = 473.11 C.c.)?
109. What is the weight in grammes of one fluidounce of glycerin?
110. What is the weight of Oj chloroform in grammes (specific gravity 1.49)?

111. What is the weight of one fluidounce of chloroform in grammes?
112. What part of a litre is a pint (to four decimal places)?
113. What part of a gallon is a fluidrachm?
114. What part of a gallon are 32 minims?
115. What part of one pound avoirdupois are $1\frac{1}{4}$ ounces troy?
116. What is the specific gravity of a piece of wood which weighs in air 177.45 grains? A piece of brass weighs 68.25 grains when immersed in water. The wood and brass together immersed in water weigh 85.7 grains.
117. A piece of wood (specific gravity = 1.6), when weighed in oil of turpentine (specific gravity = .87), loses 217.5 grains in weight: what is its weight? (Its loss in weight (in oil) divided by the specific gravity of the oil is equal to its loss in weight in water. This multiplied by its specific gravity gives its weight.)
118. A bottle full of water weighs 31 ounces avoirdupois; the same bottle filled with oil (specific gravity 0.91) weighs 29 ounces 245 grains avoirdupois. How many avoirdupois ounces of water will the bottle hold? What is the weight of the bottle?

NOTE.—To find the capacity divide the difference between the two weights by the difference between the two specific gravities.

119. How many C.c. would the same bottle hold? (See No. 118.)
120. What is the weight of a piece of iron 25 inches long, 4 inches wide, and 2 inches thick, its specific gravity being 7.8 (cu. in water = 252.509 gr.)?
121. What is the capacity in C.c. of a vessel which will hold 2 pounds avoirdupois of glycerin?
122. If one pound avoirdupois of lead, when weighed in water, loses 611 grains, what is its specific gravity?
123. A bar of iron, when immersed in water, loses 13 per cent. of its weight: what is its specific gravity?
124. A piece of copper, when immersed, loses $\frac{1}{9}$ of its weight: what is its specific gravity?
125. A troyounce of silver, when weighed in water, weighs 434.72 grains: what is its specific gravity?
126. A druggist proposes exchanging 5 pints of carbolic acid (specific gravity 1.065), valued at 40 cents per pound (avoirdupois), for 5 pints of glycerin (U. S. P.), valued at 32 cents per pound: does he gain or lose by the exchange, and how much?
To find the specific gravity of a liquid by immersing a solid in it: *Immerse in it a solid of known specific gravity and weight; carefully note its loss of weight when thus immersed; then use the proportion. As its weight in air is to its specific gravity, so is its loss of weight when immersed in the liquid to the specific gravity of that liquid.* If the weight of the solid is made the same number in grains as its specific gravity, its loss of weight, when immersed in the liquid, is equal to the specific gravity of the liquid.
127. A piece of iron weighs 1560 grains; its specific gravity is 7.8. When immersed in syrup it loses 262 grains' weight: what is the specific gravity of the syrup?
128. A piece of aluminum weighing 256 grains, having the specific gravity 2.56, loses 82 grains when immersed in a liquid: what is the specific gravity of the liquid? What is the liquid?
129. What is the volume of a block of ice 12 feet long, 8 feet wide, and 2 feet thick? What is its weight, and how many cubic feet of water will it yield when melted, supposing that water upon freezing increases in volume $\frac{1}{15}$? (See No. 120.)
130. How many gallons and parts and how many pounds and parts of water will it take to fill a vessel 14 inches wide, 21 inches long, and 9 inches deep (cu. in. water = 252.509 gr.)?
131. What is the specific volume of mercury?
132. What is the specific volume of diluted sulphuric acid?
133. What is the specific volume of glycerin?
134. What is the specific volume of iodoform?
135. How much (wine measure) will one pound (avoirdupois) tincture of chloride of iron measure (specific gravity = .980)?
136. If 65.1 Gm. of Rochelle salt be divided into seven powders, what would be the volume of water equal to the weight of one powder?
137. How much nitrate of silver must be used to make 2 fluidounces of a 4-per-cent. solution of the nitrate? (See No. 17.)
138. A bottle when filled with syrup (specific gravity 1.31) contains 23.58 ounces (av.): how much nitric acid (specific gravity 1.42) will it contain?
139. A bottle when filled with syrup (specific gravity 1.31) weighs 36 ounces, 285

grains (av.), when filled with oil (specific gravity .9) it weighs 30 ounces, 219 grains: what is the weight of the bottle? Of the syrup? Of the oil? (See No. 118.)

140. A bottle when filled with syrup (specific gravity 1.31) weighs 34.96 ounces (av.), when filled with nitric acid (specific gravity 1.42) it weighs 36.72 ounces: what is the weight of the bottle, and how much water will it hold? (See No. 118.)

141. A bottle filled with water weighs 32 ounces (av.), when filled with chloroform (specific gravity 1.47) it weighs 39.755 ounces (av.), when filled with acid it weighs 34.64 ounces: what acid does it contain? (See No. 118.)

ALLIGATION APPLIED TO PHARMACY.

(The answers to these questions will be found in the Appendix.)

Rules for ascertaining the quantities of drugs of different percentages of strength, to be used in making a mixture of definite strength; also of liquids where no change of volume takes place when mixed.

PERCENTAGES.

Rule.—*Write the percentages of the different ingredients in a horizontal row; connect with a line each percentage which is greater than that of the mixture sought with one that is less, and each one that is less than that of the mixture sought with one that is greater; then write the difference between the percentage of the mixture sought and that of each of the ingredients under the percentage of the other ingredient or ingredients with which it is connected by the line. The figures thus placed under each percentage will be found to indicate the proportionate parts (by weight) of each ingredient to be used.*

It is apparent that where there are more than two ingredients there will be an indefinite number of ratios. Either one of the ingredients of less strength than the mixture may vary, and therefore one or more of the other ingredients must vary correspondingly.

The same rules are applicable to liquids of different specific gravities (where no change of volume takes place when they are mixed), writing "specific gravities" in place of "percentages."[1]

SPECIFIC GRAVITIES.

Rule.—*Write the specific gravities of the different ingredients in a horizontal row; connect with a line each specific gravity which is greater than that of the mixture sought with one that is less, and each one that is less than that of the mixture sought with one that is greater; then write the difference between the specific gravity of the mixture sought and that of each of the ingredients under the specific gravity of the other ingredient or ingredients with which it is connected by the line. The figures thus placed under each specific gravity will be found to indicate the proportionate parts (by measure) of each ingredient to be used.*

1. In what proportion must two quantities of powdered opium, containing respectively 7 and 18 per cent. of morphine, be mixed so that the mixture shall contain 16 per cent.?

16		*Answer.*	*Proof.*
7	18	2 parts of 7 p. c.	$2 \times 7 = 14$
2	9	9 parts of 18 p. c.	$9 \times 18 = 162$
		11 parts.	$11)176$
			16

2. In what proportions to yield a mixture of 14 per cent.? (See No. 1.)

3. In what proportions may three quantities, containing respectively 7, 16, and 18 per cent., be mixed so that the mixture shall contain 14 per cent.?

---

[1] Of course, mixed liquids which contract may be allowed to stand until contraction ceases, and sufficient liquid can then be added to make up the intended measure.

14		
7	16	18
2	7	7
4		
6		

Answer.

6 parts of 7 p. c.	=	42
7 parts of 16 p. c.	=	112
7 parts of 18 p. c.	=	126
20 parts.		2 0)28.0
		14

When there are three or more ingredients the proportion of these may be varied indefinitely, as will appear from the following:

In the preceding example suppose that only one part of that containing 16 per cent., and the same number of parts containing 7 per cent. as before be used, it will then require more than 7 parts of that containing 18 per cent. to make the mixture contain 14 per cent.

When the quantities of more than one ingredient are given, each quantity may be multiplied by its percentage and the sum of the products divided by the sum of the quantities; this will give the mean percentage of the quantities.

Thus 6 parts of 7 p. c. } 1 part of 16 p. c. } = 7 parts of $8\frac{2}{7}$ p. c.

$$\begin{array}{l} 6 \times 7 = 42 \\ 1 \times 16 = 16 \\ \hline 7 \quad)58 \\ \quad 8\tfrac{2}{7} \text{ p. c.} \end{array}$$

14	
$8\frac{2}{7}$	18
4	$5\frac{5}{7}$

and it will require 4 parts of $8\frac{2}{7}$ per cent. and $5\frac{5}{7}$ parts of 18 per cent. to make a mixture containing 14 per cent. Now if 4 parts of $8\frac{2}{7}$ per cent. require $5\frac{5}{7}$ parts of 18 per cent., then 7 parts of $8\frac{2}{7}$ per cent. will require 10 parts of 18 per cent., or 4 : $5\frac{5}{7}$ :: 7 : 10; therefore the mixture will be—

6 parts of 7 p. c.	$6 \times 7 = 42$
1 part of 16 p. c.	$1 \times 16 = 16$
10 parts of 18 p. c.	$10 \times 18 = 180$
	17)238(14
	17
	68
	68

The different percentages may be connected in various ways, care being taken that in every case one larger than the required mixture shall be connected with one smaller, but every one must be connected with some other.

4. In what proportions may four quantities, containing respectively 7, 8, 16, and 18 per cent., be mixed so that the mixture shall contain 14 per cent.?

14			
7	8	16	18
4	2	6	7

Answer.

4 parts of 7 p. c.	=	28
2 parts of 8 p. c.	=	16
6 parts of 16 p. c.	=	96
7 parts of 18 p. c.	=	126
19 parts.		19)266(14

Or,

14			
7	8	16	18
2	4	7	6

Answer.

2 parts of 7 p. c.	=	14
4 parts of 8 p. c.	=	32
7 parts of 16 p. c.	=	112
6 parts of 18 p. c.	=	108
19 parts.		19)266(14

5. In what proportions may four quantities, containing respectively 9, 15, 16, and 18 per cent., be mixed, so that the mixture shall contain 14 per cent.?

14			
9	15	16	18
1	5	5	5
2			
4			
7	5	5	5

6. In what proportions may five quantities, containing respectively 7, 8, 9, 11, and 16 per cent., be mixed, so that the mixture shall contain 14 per cent.?

7. How much of each kind of scammony, containing respectively 77 per cent., 83 per cent., and 92 per cent., may be used to make a mixture containing 85 per cent.?

8. How much scammony of 90 per cent. must be mixed with 7 ounces of 80 per cent. and 5 ounces of 82 per cent. to make the mixture contain 85 per cent.?

$$\left.\begin{array}{l}7\text{ oz.}\times 80\text{ p. c.} = 560\\ 5\text{ oz.}\times 82\text{ p. c.} = \underline{410}\end{array}\right\} = 12\text{ oz. of } 80\tfrac{5}{6}\text{ p. c.}$$

$$12)\underline{970}\qquad 80\tfrac{5}{6}$$

```
      85
  ┌────────┐
 80⅚      90
 ───────────
  5       4⅙
```

Then if 5 ounces of the mixture require 4⅙ ounces of 90 per cent., 12 ounces of mixture will require 10 ounces of 90 per cent. 5 : 4⅙ :: 12 : 10.

```
 7 oz. × 80 p. c. =  560
 5 oz. × 82 p. c. =  410
10 oz. × 90 p. c. =  900
22                22)1870(85
                     176
                     ───
                     110
                     110
```

9. What quantities (by measure) of glycerin (specific gravity 1.250) and alcohol (specific gravity .820) must be mixed to have the specific gravity 1.

```
      1.000
  ┌──────────┐
1.250      .820
───────────────
 180        250
```

180 or 18 parts glycerin.
250 or 25 parts alcohol.
48

18 × 1.25 = 22.50
25 × .820 = 20.50
43.

43 ÷ 43 = 1.000

10. What quantities (by measure) of glycerin (specific gravity 1.250) and diluted alcohol (specific gravity .928) must be mixed to have the specific gravity 1.

11. How much each of alcohol 94 per cent. and 60 per cent. must be used to make 100 ounces (by weight) of 80 per cent.?

```
       80
    ┌──────┐
    94    60
    ────────
    20    14
Or, 10     7
```

17 : 10 :: 100 : 58.82

```
 100.
  58.82 of 94 p. c.
 ──────
  41.18 of 60 p. c.
```

When the quantity of one of the ingredients is given, to find the quantities of the other ingredients:

Proceed as before to find the ratios of the ingredients; then by proportion. As the ratio of that ingredient of which the quantity is given is to its quantity, so is the ratio of each ingredient to its quantity.

12. How much alcohol and how much glycerin must be mixed with 24 C.c. of syrup (specific gravity 1.31) to make 250 C.c. of mixture having the specific gravity 1. (no allowance for contraction)?

```
  24       250        250
  1.31      24         31.44
  ────     ───        ──────
  24       226    226)218.56(.967
  72                  2034
  24                  ────
  ────                1516      24 parts sp. gr. 1.31
  31.44               1356     226 parts sp. gr.  .967
                      ────
                       1600
                       1582
                       ────
                         18
```

```
     .967
  ┌────────┐
 .820    1.25
 ────────────
  283     147
```

283 alcohol,
147 glycerin,
430

```
 .820      232
 1.25      183.5
           ─────
           415.5

430)415.5(.966+
     3870
     ────
     2850
     2580
     ────
     2700
```

If 430 parts of mixture require 283 alcohol, how much will 226 require?

430 : 283 :: 226 : 148.7; then 226 — 148.7 = 77.3

148.7 C.c. alcohol, 77.3 C.c. glycerin, 24 C.c. syrup.

When the quantity of more than one ingredient is given, each quantity may be multiplied by its specific gravity and the sum of the products divided by the sum of the quantities; this will give the mean specific gravity of the quantities.

13. In what proportions must three pints each of alcohol (specific gravity 0.935 and 0.865) be mixed with alcohol of specific gravity 0.820 so that the mixture shall have the specific gravity 0.835?

3 × 0.935 =	2805
3 × 0.865 =	2595
6	6)5400
	900

3 pints of 0.935 and 3 pints of 0.865 are equal to 6 pints of 0.900 (mean specific gravity).

Then,

0.835	
0.820	0.900
65	15
13	3

as 3 pints of specific gravity 0.900 are required to be mixed with 13 pints of .820 to make the specific gravity 0.835, so 6 pints will require twice 13 pints, or 26 pints of alcohol (specific gravity 0.820), to be added to 3 pints each of 0.865 and 0.935 to bring the whole to specific gravity 0.835.

14. How much opium containing 8 per cent. of morphine must be mixed with 10 troy ounces of opium containing 17 per cent. to make the mixture contain 14 per cent.?

15. How much opium of 16 per cent. must be mixed with 1 troy ounce of opium of 12 per cent. to make the mixture 13 per cent.?

16. How much scammony of 92 per cent. must be mixed with 1 troy ounce of 75 per cent. to make the mixture 85 per cent.?

17. How much alcohol of 35 per cent. (by weight) will 1 quart of alcohol (U. S. P.) make on dilution with water?

18. How much opium of 16½ per cent. must be mixed with 4 ounces (10 per cent.) and 5 ounces (11 per cent.) to make the mixture 14 per cent.?

19. How much opium of 15¼ per cent. must be mixed with 3 ounces (9 per cent.), 3¼ ounces (10 per cent.), and 3¼ ounces (12 per cent.) to make the mixture contain 14 per cent.?

When the quantity of the mixture and the percentages of the ingredients are given, to find the quantity of each of the ingredients:

Proceed as before to find the ratio of the ingredients, and then by proportion. As the whole amount of difference is to any one difference, so is the amount of the required mixture to the required amount of that particular difference.

20. An apothecary has opium of the following percentages, viz.: 8, 11, 16, and 18: how much of each kind may be used to make 10 troy ounces of 14 per cent.?

14			
8	11	16	18
2	4	6	3

2 × 8	=	16
4 × 11	=	44
6 × 16	=	96
3 × 18	=	54
15		15)210(14
		15
		60
		60

15 : 2 :: 10 : to the required amount of 8 per cent.

2 ounces = 960 grains. 15 : 960 :: 10 : 640 grains.

If 2 parts correspond to 640 grains, 3 parts will correspond to 960 grains, 4 parts to 1280 grains, and 6 parts to 1920 grains; thus,

15 : 1920 :: 10 : 1280
15 : 2880 :: 10 : 1920
15 : 1440 :: 10 : 960

640 grains,	8 p. c.
1280 grains,	11 p. c.
1920 grains,	16 p. c.
960 grains,	18 p. c.
4800 grains = 10 troy ounces.	

21. How many parts by weight of officinal alcohol must be added to diluted alcohol to make it the strength of 60 per cent. by weight?

	60	
45.5		91
31		14.5

31 parts,	45.5	=	1410.5
14.5 parts,	91	=	1319.5
45.5			2730.0

$2730 \div 45.5 = 60$

22. How much to 1 pound (avoirdupois)? (See No. 21.)

23. An apothecary has two kinds of opium, one 18$\frac{1}{2}$ per cent., the other 16 per cent; he desires to make 8 troy ounces of 14 per cent.: how much of the weaker kind must he use?

24. I have two qualities of cinchona, containing respectively 1$\frac{3}{5}$ and 3$\frac{7}{8}$ per cent. of quinine: how much of each shall I take to make the mixture contain 2 per cent.?

	2	
1$\frac{3}{5}$		3$\frac{7}{8}$
1$\frac{7}{8}$		$\frac{2}{5}$

1$\frac{7}{8}$ oz.	=	900 grains,	75
$\frac{2}{5}$ oz.	=	192 grains,	16

25. Two qualities containing $\frac{4}{5}$ of 1 per cent. and 3$\frac{1}{4}$ per cent.: how much of each shall I take to make the mixture contain 2 per cent.?

26. Two qualities containing 1.285 per cent. and 2.345 per cent.: how much of each shall I take to make the mixture contain 2 per cent.?

27. Two qualities containing 1.676 per cent. and 3.188 per cent.: how much of each shall I take to make the mixture contain 2 per cent.?

28. Three qualities: .840 per cent., 1.848 per cent., and 2.688 per cent.: how much of each shall I take to make the mixture contain 2 per cent.?

29. Having the three qualities, as before, and having 5 ounces of the percentage .840, how much of the mixture will it yield?

If 43 parts are equal to 5 oz.,		.840
82 parts are equal to 9 oz., 256$\frac{3}{4}$ grains,		2.688
48 parts are equal to 5 oz.,		1.848
oz. 19 + 256$\frac{3}{4}$ grains.		

30. Having the three qualities, as before, with 5 ounces of the percentage .840, and wishing to make 32 ounces of the mixture, how much of each of the others must be used?

In this case proceed to find by previous rules how much of percentage 2.688 will be required to mix with the 5 ounces, .840, to make the mixture 2 per cent.

This amount of mixture subtracted from 32 ounces will give the amount remaining to be made up of the other two percentages,—1.848 and 2.688.

	2	
0.840		2.688
.688		1160
86		145

86 : 5 : : 145 : 8.4302

5 oz.	of	0.840
8.4302 oz.	of	2.688
13.4302 oz.	of	2 p. c.

Subtracting this from 32 ounces leaves 18.5698 ounces to be made up.

	2	
1.848		2.688
.688		152
86		19

86
19
105 : 18.5698 oz. : : 86 : 15.2095 oz. of 1.848.

Or, subtracting this from 18.5698 ounces gives 3.3603 of 2.688; adding 8.4302 gives the whole amount used of 2.688 per cent. = 11.7905.

31. A solution of tersulphate of iron is found to have the specific gravity 1.3464: how much water must be added to make it of the officinal strength (1.320)?

	1.3200	
1.3464		1.000
.3200		.0264
Or, 32		2.64

32 fl. oz. of solution.
2.64 fl. oz. of water.

32. How much water must be added to 5 pints of solution of tersulphate of iron (specific gravity 1.3464) to make it of the officinal strength?

33. A solution of tersulphate of iron is found to have the specific gravity 1.312: how can it be made of the officinal strength?

The easiest method is to evaporate a portion of it until its specific gravity is considerably above the officinal strength (1.820) and then mix the proper quantities of the two solutions.

Suppose a portion of it has been evaporated until it has the specific gravity 1.882: how much of each solution must be taken to make 24 fluidounces of specific gravity 1.820?

	1.820	
	1.812	1.882
	12	8
Or,	3	2

$$\left.\begin{array}{l}\text{3 fl. oz. of 1.312} \\ \text{2 fl. oz. of 1.882}\end{array}\right\} = \text{5 fl. oz. of 1.820.}$$

5 : 3 :: 24 : 14.4 — 14.4 fl. oz. of sp. gr. 1.812

5 : 2 :: 24 : 9.6 — 9.6 fl. oz. of sp. gr. 1.882

34. How much water must be added to 2 pounds of stronger water of ammonia (28 per cent.) to reduce it to water of ammonia (10 per cent.)?

10	
28	0
10	18

10 : 18 :: 32 : 57.6 oz. water.

35. How much water must be used to make 2 pounds of 10 p. c. water of ammonia?

36. How much officinal alcohol (vol.) must be added to 2 pints of alcohol of 76 per cent. (vol.) to make it 81 per cent. (vol.) (no allowance for contraction)?

37. How much officinal alcohol (vol.) must be added to 2 pints of 70 per cent. (by volume) to make the mixture 85 per cent. by weight, 87.8 by volume (no allowance for contraction)?

QUESTIONS ON CHAPTER I.

METROLOGY.

Define Metrology.

What does its present and less strict definition include?

What is weight?

What is measure?

What is specific gravity?

In the history of Metrology, how many distinctly-marked periods may be traced?

Describe the peculiarities of each period.

What was the original weight of the English silver penny?

What is the origin of the avoirdupois pound?

How did the custom originate of druggists using one system of weights for buying drugs and another for compounding them?

When were the Imperial measures and standards adopted in Great Britain?

What relation does the yard bear to the length of a pendulum beating seconds?

What is the weight in grains of the pound troy?

What is the weight in grains of the pound avoirdupois?

What is the weight in grains of a cubic inch of distilled water?

What is the weight of an Imperial gallon of distilled water?

What is the weight of a wine gallon of distilled water?

How many cubic inches does a wine gallon contain?

How is the pound troy divided?

How is the pound avoirdupois divided?

What is the difference in grains between the troy ounce and the avoirdupois ounce?

What is the difference in grains between the troy pound and the avoirdupois pound?

How is the U. S. wine gallon divided?

How is the Br. Imperial gallon divided?

What is the weight in grains of a pint of distilled water (U. S.)?

What is the weight in grains of a fluidounce of distilled water (U. S.)?

What is the weight in grains of a troy ounce of distilled water (U. S.)?

What is the weight in grains of an avoirdupois ounce of distilled water?
What is the weight in grains of an Imperial fluidounce of distilled water (Br.)?
What is the estimated capacity of a teacupful?
What is the estimated capacity of a wineglassful?
What is the estimated capacity of a tablespoonful?
What is the estimated capacity of a teaspoonful?
What is the standard or unit of measurement in the metric or decimal system?
How is it derived?
Why is the system called the metric system?
Why is the system called the decimal system?
How is the unit of capacity derived?
How is the unit of weight derived?
How are the multiples of the various units expressed?
How are the divisions of the various units expressed?
What word has been suggested as a useful mnemonic?
Give the names of the various denominations of length.
Give the names of the various denominations of capacity.
Give the names of the various denominations of weight.
Which of these terms are used in the U. S. Pharmacopœia?
What is the meaning of a micromillimetre?
What are the chief merits of the metric system?
What is the length of a metre?
What is the capacity of the litre in pints?
What is the measure of a gramme of distilled water?
What is the weight of a gramme in grains?
What is the chief disadvantage of the metric system?
How are the metric weights usually divided?
How can you convert metres into inches?
How can you convert centimetres into inches?
How can you convert millimetres into inches?
How can you convert litres into fluidounces?
How can you convert litres into pints?
How can you convert litres into Imperial pints?
How can you convert litres into Imperial gallons?
How can you convert cubic centimetres into fluidounces?
How can you convert cubic centimetres into Imperial fluidounces?
How can you convert grammes into grains?
How can you convert grammes into avoirdupois ounces?
How can you convert grammes into troy ounces?
How can you convert centigrammes into grains?
How can you convert milligrammes into grains?
How can you convert kilogrammes into avoirdupois ounces?
How can you convert kilogrammes into avoirdupois pounds?
How can you convert kilogrammes into troy ounces?
How can you convert inches into metres?
How can you convert inches into centimetres?
How can you convert inches into millimetres?
How can you convert pints into litres?
How can you convert fluidounces into cubic centimetres?
How can you convert Imperial pints into litres?
How can you convert Imperial gallons into litres?
How can you convert Imperial fluidounces into C.c.?
How can you convert grains into grammes?
How can you convert grains into centigrammes?
How can you convert grains into milligrammes?
How can you convert avoirdupois ounces into kilogrammes?
How can you convert avoirdupois ounces into grammes?
How can you convert avoirdupois pounds into kilogrammes?
How can you convert troy ounces into kilogrammes?
How can you convert troy ounces into grammes?
How are the metric units spelled by the French?
How are the metric units spelled by the U. S. Pharmacopœia?
How should 0.050 m. be read?
How should 0.055 m. be read?
How should 0.0555 m. be read?
In measures of capacity less than a litre, what terms are used?

In weight, when the quantity is relatively large, what terms are used?
In quantities less than a kilogramme and greater than a gramme, what terms are used?
In quantities below the gramme, what terms are used?
What is a balance?
What particulars are necessary to obtain correct results?
Name the various kinds of pharmaceutical balances in use.
Describe a single beam, equal arm balance.
When the beam is in a horizontal position, where should the centre of gravity be?
Give a simple illustration of the principle of suspending a beam.
What particulars are necessary in regard to the end knife-edges?
What is the effect if the end knife-edges are not equidistant from the central knife-edge?
What if the central knife-edge is not in line with the end knife-edges?
What if the knife-edges are not parallel with each other?
What are the requisites for the beam of a fine balance in order to secure accuracy in weighing?
Why should the beam of the balance be rigid and non-elastic?
Why should it be no heavier than necessary in order to secure the requisite strength?
What advantages have agate knife-edges and planes over those made of steel?
How may a balance be tested for accuracy?
What are the advantages of having the balance supported by a rigid metallic column?
Wherein does an analytical balance differ from an ordinary prescription balance?
What sort of counter scales was formerly in use?
What has taken its place generally in more recent times?
Upon what principle are the single beam, unequal arm balances constructed?
Describe the vest-pocket prescription balance.
Describe the double beam, unequal arm balance.
What are its advantages?
Describe a scale made to weigh liquids.
What is the principal objection to such balances?
What principle is adopted in making platform scales?
What is the principle of the torsion balance?
Of what weights does a pile of avoirdupois weights consist?
What is meant by block weights?
What is the objection to the use of a wooden block?
How are troy weights usually arranged?
How are iron metric weights usually shaped?
What weights are generally used for analytical purposes?
What is the best material and form for grain weights for prescription purposes?
Why are aluminum weights preferable to brass?
What are the advantages of aluminum wire weights?
What measures are commonly used for measuring liquids when the quantity is more than a pint?
What when the quantity is one pint or less?
What effect has denting upon tinned iron or copper measures?
Describe the forms of graduated glass measures in common use.
Which is preferable, and why?
Describe Hodgson's graduated measures.
Describe Hobb's graduated measures.
What is an objection to either of these, and how may it be remedied?
What objection is there to using minim graduated measures?
How may greater accuracy be obtained?
How is a pipette used?
Do the terms minim and drop always mean the same?
About how many drops are there in a fluidrachm of water? *Ans.* 60.
In a fluidrachm of syrup of acacia? *Ans.* 44.
In a fluidrachm of chloroform? *Ans.* 250.
In a fluidrachm of tincture of opium? *Ans.* 130.
What is specific gravity?
How much weight does a body lose by being immersed in water?
What is the rule for finding the specific gravity of a body?

How is the specific gravity taken of a solid, insoluble in but heavier than water, by means of a balance?

How by means of a specific-gravity bottle?

How by means of a graduated tube?

How by immersing it in a liquid of the same specific gravity?

How is the specific gravity taken of a solid soluble in but heavier than water?

How is the specific gravity taken of a solid insoluble in but lighter than water?

How of a solid soluble in but lighter than water?

Describe a specific-gravity bottle.

Can an ordinary bottle be used for this purpose?

State how this can be done.

What are Lovi's or specific-gravity beads?

What is a hydrometer or areometer?

What two classes of hydrometers are there?

Describe Baumé's hydrometer.

What is the difference between the one for light liquids and the one for heavy liquids?

Why is the zero mark placed near the top in hydrometers for heavy liquids?

Describe the specific gravity scale hydrometer.

What is the object of having two bulbs blown in the glass at the lower end of the hydrometer?

Which is the more accurate for taking specific gravity,—the hydrometer or the specific-gravity bottle,—and why?

Which is more likely to give a correct indication of specific gravity,—a hydrometer having an elongated bulb with cylindrical sides, or one having an oval or globular bulb,—and why?

What is a urinometer, and how is it usually graduated?

What is the specific gravity of healthy urine?

What is the specific gravity of diabetic urine?

What is a saccharometer, and how is it graduated?

What is an elæometer?

What is a lactometer?

What does an alcoholmeter usually indicate?

Describe Tralles's hydrometer.

Describe Cartier's hydrometer.

Describe Gay-Lussac's centesimal alcoholmeter.

Describe Sikes's hydrometer.

Describe Jones's hydrometer.

Describe Dica's hydrometer.

Describe Twaddell's hydrometer.

Describe Beck's hydrometer.

Describe Zanetti's hydrometer.

Describe Fahrenheit's hydrometer.

Describe Nicholson's hydrometer.

Describe Mohr's specific-gravity apparatus.

Describe Gannal's method of taking specific gravity of a liquid.

How can a specific-gravity pipette be used to show specific gravity?

Describe Rousseau's densimeter.

What is specific volume?

How can you obtain the volume of a given weight of a liquid?

CHAPTER II.

OPERATIONS REQUIRING THE USE OF HEAT.

Generation of Heat.

THE consideration of the theories which have been advanced from time to time to explain the phenomenon of heat, although very interesting and instructive, cannot be treated of in a work of this character, and the reader is therefore referred to any of the recent works on physics, which are everywhere accessible. The view which is now almost universally accepted is that known as the dynamical theory of heat, in which it is assumed that heat is produced by the constant motion of the particles composing the body, and that heat varies in quantity and kind according as the body is *solid*, *liquid*, or *gaseous*.

It will be convenient to consider the various practical operations and appliances for generating heat under three heads:

1. Operations and forms of apparatus in which *solids* are used in developing heat.
2. Those in which *liquids* are used in developing heat.
3. Those in which *gases* are used in developing heat.

OPERATIONS AND FORMS OF APPARATUS IN WHICH SOLIDS ARE USED IN DEVELOPING HEAT.

Kinds of Fuel.—Under this head is included the very well known employment of solid fuel, as wood, charcoal, anthracite coal, bituminous coal, coke, etc.

Wood is seldom relied upon as fuel in pharmaceutical operations where a regular, well-sustained heat is desired, yet from its wide distribution, ready inflammability, and comparative cheapness it is indispensable in kindling a fire. The large quantity of unconsumed carbon which is either lost in smoke or deposited upon vessels that are being heated constitutes the chief objection to its use.

Charcoal is more convenient, although more costly, than wood: it ignites easily, burns readily, and leaves but little residue. On account of its ready combustibility, it is well fitted for operations requiring a quick, strong heat.

Anthracite coal is probably the best form of solid fuel for general use, being the most economical: its hard, dense structure renders it difficult

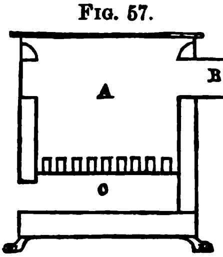
to kindle, but where a long-continued, strong heat is desired it is to be preferred.

Bituminous or *semi-bituminous coal* affords a strong heat, but it is not equal to anthracite as fuel for pharmaceutical purposes. Unconsumed carbon is found in the smoke in large quantity, and this is apt to condense on the surfaces of kettles, vessels, etc., which are being heated, and the deposits of soot are uncleanly and often difficult to remove.

Coke, the residue obtained from the distillation of coal at gas-works, is an excellent fuel, and may be used either mixed with coal or by itself: it is more easily kindled than anthracite.

Pharmaceutical Furnaces, etc.—Much ingenuity has been used in the contrivance of various forms of furnaces, ranges, stoves, etc., to meet general or special applications, yet in all there are certain fundamental principles of construction which must be well understood if faults are to be avoided. The elements of a furnace are the *air-flue*, *combustion-chamber*, and *vent* or *chimney*, and the relative proportions of these must depend upon the special object sought in the construction of the furnace, and the character of the fuel that is to be used. Fig. 57 represents a sectional view of a pharmaceutical furnace,—C being the air-flue, A the combustion-chamber, and B the vent.

FIG. 57.



Pharmaceutical furnace (sectional view).

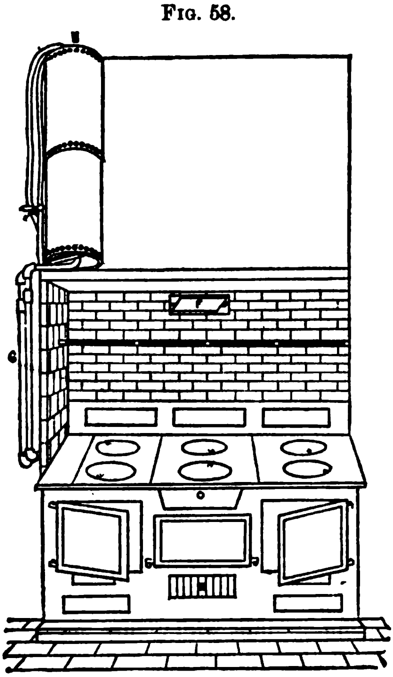
Coal being the principal solid fuel in use, it will be most appropriate to treat of those furnaces adapted for its combustion, and therefore the chemical constitution of coal and the theory of its combustion must be noticed. Hard anthracite, which is the best kind of coal for pharmaceutical furnaces, usually has a specific gravity of 1.550, and has been shown to consist of 94 per cent. carbon, 0.40 per cent. hydrogen, and 1.26 per cent. oxygen; there are also apt to be present 2 per cent. of water and about 2.3 per cent. of incombustible impurities or ash, consisting of ferric oxide, silica, alumina, magnesia, lime, etc. The poorer grades of this kind of coal contain from 85 to 90 per cent. of carbon. Anthracite may be distinguished from other varieties by its rich, glassy lustre, its peculiar conchoidal fracture, and its hard, dense structure: it burns freely, without black smoke, showing the absence of unconsumed carbon. Soft anthracite or *semi-bituminous* coal has a tendency, when broken into pieces, to assume the form of irregular cubes, and to crumble easily when pressed: it burns freely, but with the production of large quantities of black smoke. The heat produced by its combustion is very strong, and it is largely used in many parts of the United States.

The combustion or oxidation of coal requires the presence of a certain quantity of air in contact with the burning coal to furnish enough oxygen to combine properly with the carbon of the fuel. The result of the combination is carbon dioxide, CO_2, and carbon monoxide, CO, both of which are gases. It is very important to provide means of escape for these gaseous compounds, as they are both poisonous, and the former is a decided non-supporter of combustion. Theoretically, it has been calculated that one hundred and fifty cubic feet of air are necessary to

consume perfectly one pound of coal in an ordinary furnace, but practically, because of the obstruction of the ashes, which prevents the thorough contact of the air with all parts of the glowing carbon, nearly double this amount is necessary.

Stoves and ranges are now so universally used that it would be needless to multiply illustrations of them: the proper selection of such as are suited to the special uses of the pharmacist must be left to individual decision, and will depend upon the space that can be spared and the character of the work that is to be done. One important feature should not be overlooked, however, in this connection,—*i.e.*, the addition of a boiler or water-back, whereby a constant supply of hot water can be had: where stoves are used, this can generally be effected by having a circulating hot-water boiler in a convenient corner, the pipes conveying the hot water being heated in the upper part of the combustion-chamber of the stove. If sufficient space can be appropriated, a range is very useful, particularly if a sheet-iron sliding-door can be lowered over the front to enclose the space. Now, when a communicating flue, controlled by a damper, is made to enter the chimney from the top of this space, operations can be conducted here that would otherwise be impossible, noxious vapors being at once carried off by the flue. Fig. 58 represents an ordinary range which is well adapted for many pharmaceutical operations. The front has been removed, in order to show the construction more clearly. This front is of sheet iron, and is hinged to the shelf which supports the boiler; it extends half-way over the top of the range, and when the damper, F, is opened, the vapors arising from operations conducted on the top are carried up the chimney. The hot-water boiler, B, is connected by pipes, G, with the cold-water supply in such a manner that the cold water circulates through pipes which surround the combustion-chamber, and, after becoming heated, ascends into the boiler.

FIG. 58.

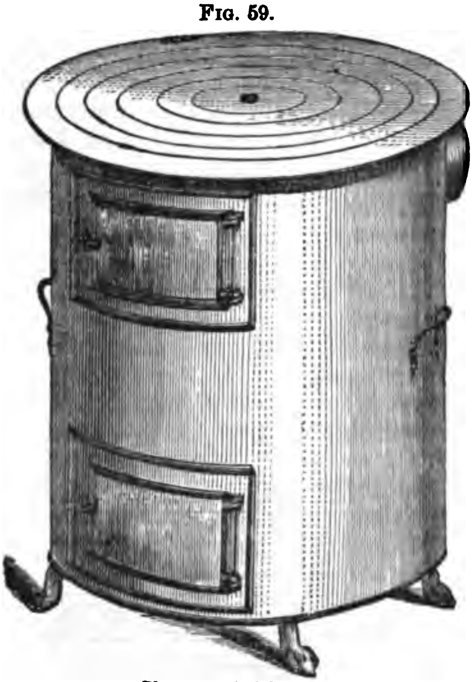


Pharmaceutical range.

Fig. 59 shows a durable pharmaceutical furnace made by Mershon's Sons, which has proved very useful in practical work. The body of the furnace is of wrought iron; it is lined with fire-brick, and the top is composed of a series of rings, which permits of the use of various-sized kettles, evaporating-dishes, etc. It has two cast-iron doors, the upper one being especially useful, as it permits the ready feeding of coal to the furnace whilst a kettle or dish is being heated, without disturbing the

latter. Fig. 57 affords a sectional view of the same furnace; and it will be noticed that the combustion-chamber, A, is sufficiently deep to contain a considerable body of ignited coal and permit the introduction of hot-water pipes. The proportion of the air-flue, C, is well arranged, whilst the vent, B, has sufficient capacity to serve all pharmaceutical purposes.

FIG. 59.



Pharmaceutical furnace.

The merits of this furnace are that the greater part of the heat rises and is available for heating the vessel placed on the rings, the heavy lining of fire-brick preventing lateral radiation to a great extent, and that, while it has all the advantages of a stationary furnace, its position can be changed repeatedly if desired, the relative proportion being so well adjusted that, whilst it is very sensitive to an increase or decrease of draught, a moderate heat may be as steadily maintained as the intensity of a strong fire.

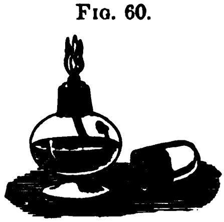
A drying-closet can be adapted to this stove by which the waste heat may be utilized. This will be described in the chapter on desiccation.

OPERATIONS AND FORMS OF APPARATUS IN WHICH LIQUIDS ARE USED IN DEVELOPING HEAT.

The liquids which are most used in pharmaceutical operations for heating are alcohol, petroleum, or coal oil, and benzin, or gasolin. All of these liquids contain carbon and hydrogen, whilst alcohol contains thirty-four per cent. of oxygen in addition.

Alcohol burns with a blue flame, which does not deposit soot, and the heat produced is intense. It is in many respects the best liquid to use for generating heat in small operations, but the expense attending its use in this country is a serious objection; for this reason it is more economical to use a glass spirit-lamp, which is provided with a ground-glass cap (see Fig. 60), than an extemporaneous lamp made from an ordinary bottle: in the latter the loss by the evaporation of the alcohol from the wick, which is exposed when the lamp is not in use, is considerable. The older forms of alcohol-lamps, such as Berzelius's, Mitchell's, etc., have almost gone out of use, being superseded by improved forms.

FIG. 60.

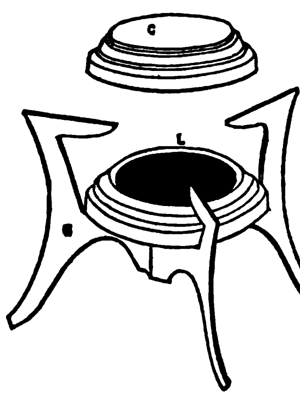


Spirit-lamp.

Fig. 61 shows one of the simplest of these very convenient spirit-lamps. L represents the lamp, S the support, and C the cover. Alcohol is poured upon the brass-wire gauze, which sinks into and is absorbed by the asbestos, or mineral wool, with which the body of the brass disk is filled; a lighted match is now applied to the gauze, which retains sufficient spirit to ignite, and a strong heat is at once obtained, the large extent of surface of the gauze producing a solid blue flame. The great advantages of spirit-lamps of this kind are that, all parts being of metal, accidents from breakage are avoided, whilst explosions cannot occur, as neither the alcohol nor its vapor is confined in a tight receptacle, and if the lamp is upset accidentally no spirit can be spilled, because it is absorbed by the asbestos. The stand, S, is hinged in the centre, and the cap, C, fits tightly on the lamp, so that loss by evaporation is prevented when not in use: all the parts of the lamp fit into a box, which may be readily carried in the pocket. Many modifications of this simple contrivance have been introduced which are elaborate and useful, but want of space prevents further notice.

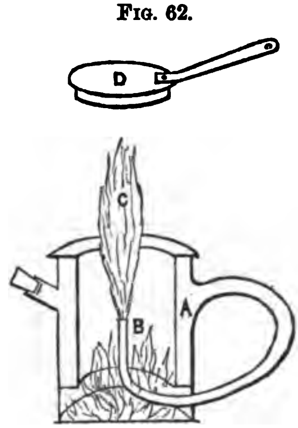
The so-called Russian blast-lamp is one of the best contrivances for generating an intense heat: it is useful when glass tubes of large diameter are to be bent, or in crucible operations. A sectional illustration is seen in Fig. 62. It is made of sheet copper, and consists of a partially-jacketed cylinder, A, with an opening on one side for introducing the

FIG. 61.



Metal spirit-lamp.

FIG. 62.



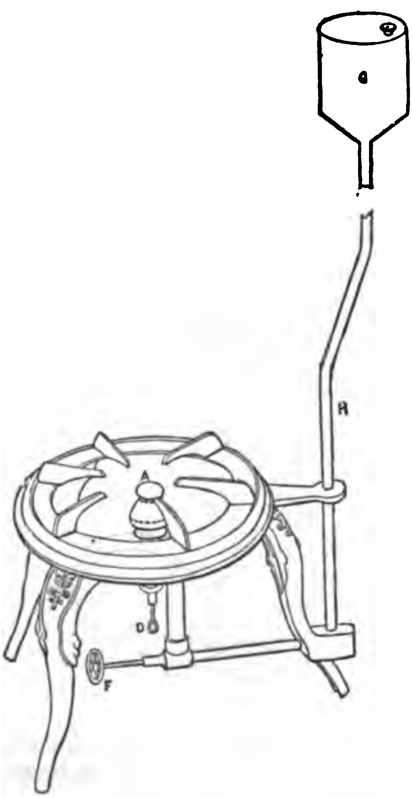
Russian blast-lamp.

alcohol, and on the opposite side a bent, tapering tube, B, which pierces the cylinder below the jacketed portion, and is turned upward as shown in the cut. The principle of action is that of the combustion of the *vapor* of the spirit. If sufficient alcohol is poured into the lamp through the side opening to half fill it, the cork loosely inserted, and half a fluidounce of alcohol poured into the large opening at the top, and then a lighted match dropped into it, the heat from the burning alcohol in the bottom of the lamp causes the alcohol contained between the jacketed sides to boil, and the vapor, having but one means of escape, rushes out by the tapering, bent tube, and at once ignites and produces a powerful

upward blast. The flame, C, may be at once extinguished by putting the cover, D, over the central opening.

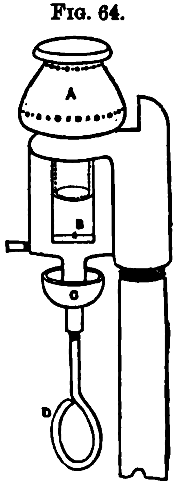
Benzin, or *Gasolin*, is now used for heating purposes, and Fig. 63 shows one of the most convenient stoves for employing this cheap but very volatile hydrocarbon. The difficulties in the use of the very inflammable and often dangerous liquids of this class for heating have been here largely overcome: to avoid a smoky, luminous flame the *vapor is burned in contact with air*, whilst to prevent explosions the reservoir for the liquid is elevated and placed four or five feet away from the ignited vapor. Fig. 63 shows the stove, and Fig. 64 an enlarged view of the burner. The reservoir, G, is filled with gasolin, care being taken at the same time to see that the valve F is closed. When the burner is to be lighted, the valve F is opened slightly, and the valve D turned very carefully, so that a small quantity of gasolin shall flow from B over the sides and collect in the cup, C. When C is full, both valves, F and D, are turned off, and a lighted match applied to C; the burning gasolin will heat the burner, A; and when all of the liquid in C has been burned and the flame extinguished, the valve D is turned on slightly and a lighted match applied at A; the parts surrounding B being hot, the gasolin *is vaporized*, and passing upward through the burner, A, issues through the numerous circular openings and is ignited; the upward current of air caused by the heat mixes with the gasolin vapor and supplies the oxygen necessary to produce a perfectly blue and intensely hot flame, the size of which is regulated by the valves D and F. When fairly ignited, F is slightly opened, and D is used to control the flame by turning to the right or left.

FIG. 63.



Gasolin stove.

FIG. 64.



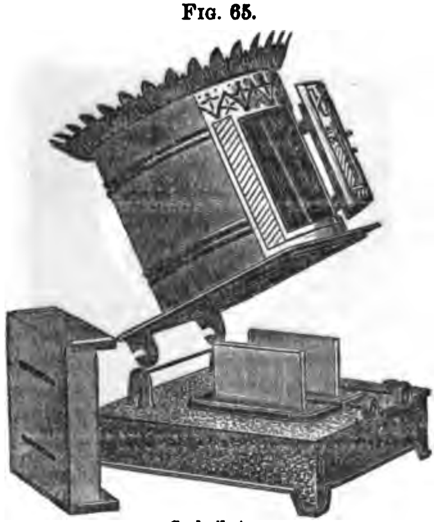
Gasolin stove burner.

Although this stove is safe in careful hands, the volatile and very inflammable character of the hydrocarbon must be constantly borne in mind. In a large laboratory in the southern part of Philadelphia these

burners are exclusively used, an elevated tank in the yard supplying the gasolin to the gas-pipes, which are conveniently laid around the sides of the room and communicate with the burners on the tables.

Kerosene, or *Coal Oil,* is so widely known as a refined petroleum product used for illuminating and heating purposes that any extended notice of its properties in a practical work would be superfluous; as it is heavier in specific gravity and has a much higher flashing-point[1] than gasolin, it is much safer for popular use. A pharmaceutical stove in which coal oil can be burned with a blue flame safely, and without the use of wicks, is yet to be contrived. There are a great many stoves to be had which are wick-burners, but these are often unsatisfactory: they are largely used, however, notwithstanding their inconveniences. Fig. 65 shows one of the best forms of this class. It is made by Adams & Westlake. The oil is poured into a reservoir in the base of the stove, the upper part is surrounded with perforated tin, which admits air to the flame and acts as a protection; the wicks, which are flat and wide, have corresponding chimneys, by which the heat is conveyed to the vessel that is to be heated. The disadvantage common to all coal-oil stoves using wicks is that the chimneys have to be high enough to secure perfect combustion and prevent smoking, and this removes the vessel that is to be heated so far from the flame that quick heating is almost impossible; in addition to this, the wicks require constant attention, and imperfect combustion frequently results even when care is exercised. In sections of our country where gas cannot be had, they are, however, indispensable, and are the most convenient generators of heat attainable.

Fig. 65.



Coal-oil stove.

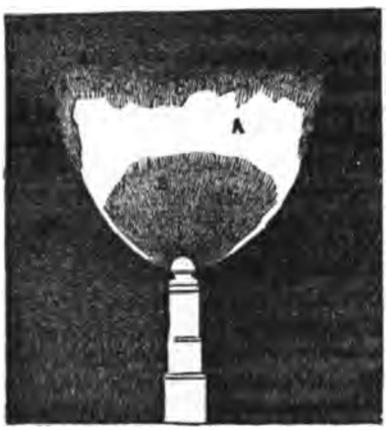
OPERATIONS AND FORMS OF APPARATUS IN WHICH GASES ARE USED IN DEVELOPING HEAT.

Gas.—The extensive employment of manufactured illuminating gas and the growing use of natural gas as sources of heat for pharmaceutical and other purposes render necessary a somewhat extended notice of gas in this connection. Illuminating gas is frequently called carburetted hydrogen, but it is really a mechanical mixture of various gases, some of which produce luminous flames and others do not; besides the hydrocarbon, CH_4 (carburetted hydrogen), which is the principal constituent,

[1] By this term is meant the temperature at which coal oil begins to give off inflammable vapor.

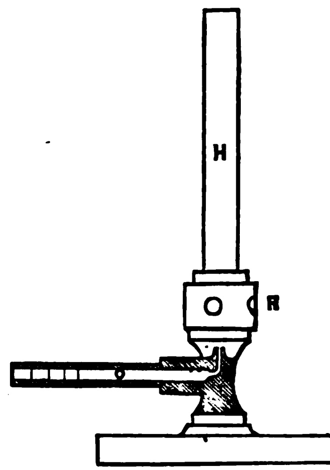
it contains condensible hydrocarbons, hydrogen, carbon dioxide, carbon monoxide, aqueous vapor, and traces of oxygen and nitrogen. Gas is usually produced by the destructive distillation of gas-coal, whilst coal-tar, gas-liquor, and coke are the liquid and solid by-products, and these are now exceedingly useful as the sources of valuable manufactures in the arts. Gas which is fitted for illuminating purposes must have its composition modified by admixture with air before it is fit for heating purposes; this may be best illustrated by the examination of an ordinary fish-tail gas-flame. In Fig. 66 it will be noticed that three zones are visible,—B, the dark central zone, which is not luminous and not at all

FIG. 66.



Gas-flame.

FIG. 67.



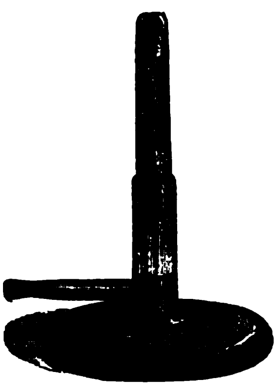
Bunsen burner (sectional view).

hot, because the gas is not fairly ignited; A, the luminous zone, where the emission of light is due to the suspension of minute particles of incandescent carbon in the flame, caused by the incomplete combustion of the gas; C, the outer non-luminous zone, the "mantle" which fringes the flame and where the particles of carbon coming in direct contact with the air are entirely consumed, the commonly accepted theory being that the oxygen in the air unites chemically with the incandescent carbon-particles, producing the invisible gases carbon monoxide and carbon dioxide.

Soon after gas came into use it was discovered that the properties which rendered it most valuable as an illuminator prevented its use as a source of heat, because of the deposition of the particles of soot from the luminous portion of the flame upon vessels that were to be heated. Dr. Duncan, of Edinburgh, showed that if gas properly mixed with air was made to enter at the bottom of a tall tinned iron cylinder, the upper end of which was covered with wire gauze, it would burn when ignited above the gauze with a blue, smokeless flame. The unnecessarily long cylinders (sometimes thirty inches) which were originally used were soon replaced by others of the length of five or six inches, for the sake of greater convenience. This discovery was at once utilized, and gas stoves and burners for various purposes came into use immediately.

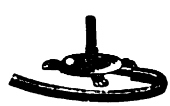
Bunsen burners are more frequently used in simple operations than any other form (see Fig. 67). The coal-gas issues from a small orifice, O, near the base, passes up through a brass tube, H, four inches high, and is ignited at the top of this tube; four large circular openings surround the small orifice at the base, and these may be closed either wholly or in part by a perforated brass ring, R; this permits the regulation of the supply of air, which mixes with the gas as it ascends the tube, and a blue, smokeless, intensely hot flame may be produced; if the perforated ring is turned so that the air-openings are closed, a luminous, smoky flame results. One of the objections to the ordinary Bunsen burner is that, after being used for a time under a low gas-pressure, when the tube becomes hot the flame will sometimes recede and the gas become ignited at the lower orifice: this may usually be avoided by gradually turning the brass perforated ring, so as to admit less air to suit the diminished pressure. Prof. Morton corrects this receding of the flame by contracting the orifice of escape at the top to about two-thirds of the area of the tube see Fig. 68). That the length of the

FIG. 68.



Bunsen burner (Morton's).

FIG. 69.



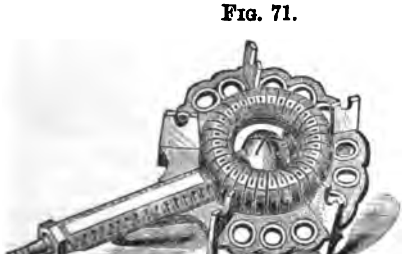
Short burner.

FIG. 70.

Short burner, with support.

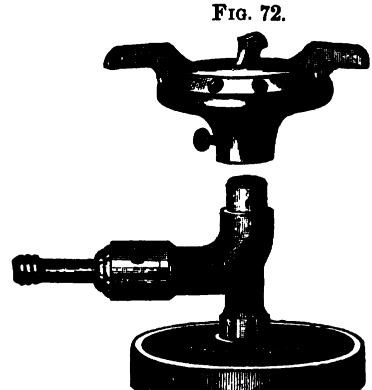
perpendicular tube does not materially affect the smokeless character of the flame may be proved by the use of the convenient little burners shown in Figs. 69 and 70. These are made by the Buffalo Dental Manufacturing Company, and have proved very useful at the prescription counter. Bunsen burners with the tube arranged horizontally have

FIG. 71.



Fletcher's radial burner.

FIG. 72.



Horizontal Bunsen burner.

grown in favor because they are less likely to be overturned, and if they have a broad base they will easily support a large vessel. Fletcher's

radial burner (see Fig. 71) has the merit of having no loose parts, and, as the casting is well annealed, it is well adapted for rough usage, the gas issuing from narrow slits cut radially in the raised circular burner; the flame is solid and non-luminous: no gauze is needed to distribute the heat. In Fig. 72 is shown a very compact and useful gas-burner, well adapted for the dispensing counter, made by Bullock & Crenshaw; it is of the horizontal Bunsen type, and is furnished with an attachment for distributing the flame, and three short legs for supporting the vessel that is to be heated.

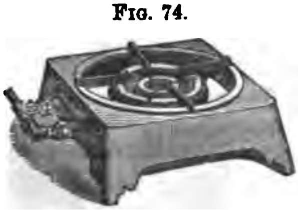
FIG. 73.

Springfield laboratory burner.

In many localities outside of cities and towns, gas made by vaporizing gasolin and mixing air with it is used for illuminating purposes. It is made by gas machines, as they are termed, the air-pump, operated by weights and pulleys or by a water-wheel, being usually located in the cellar of the residence or building, whilst the gasometer is buried underground at a safe distance. This gas is very satisfactory, but it has been only within a few years that it has been utilized for heating purposes. Special burners are required when this gas is used as an illuminant, and they require some adjustment at first to secure the proper proportion of air. Fig. 73 shows the Springfield laboratory burner, which gives a very hot, blue flame with this kind of gas, and it may also be used with ordinary gas. The milled head at the base of the burner is used to control the quantity of the gas passing through, whilst by revolving the burner itself upon the thread of the screw by which it is connected with the base the quality of the gas is determined,—*i.e.*, the proper proportion of air is admitted.

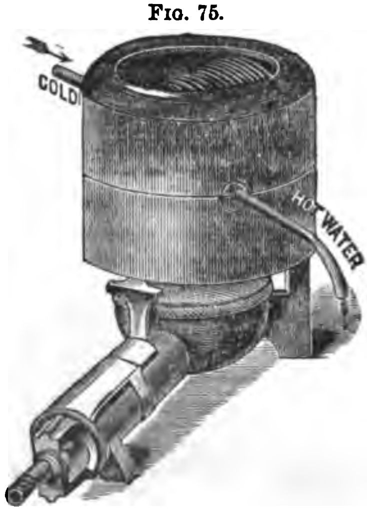
Gas stoves are now made in such variety that it seems difficult to make a judicious selection for general pharmaceutical work: the error most frequently made is in the choice of those which are intended to produce only very high temperatures. It is very seldom that a heat of great intensity is desired in pharmaceutical operations. The chief points to be secured

FIG. 74.



Economy furnace.

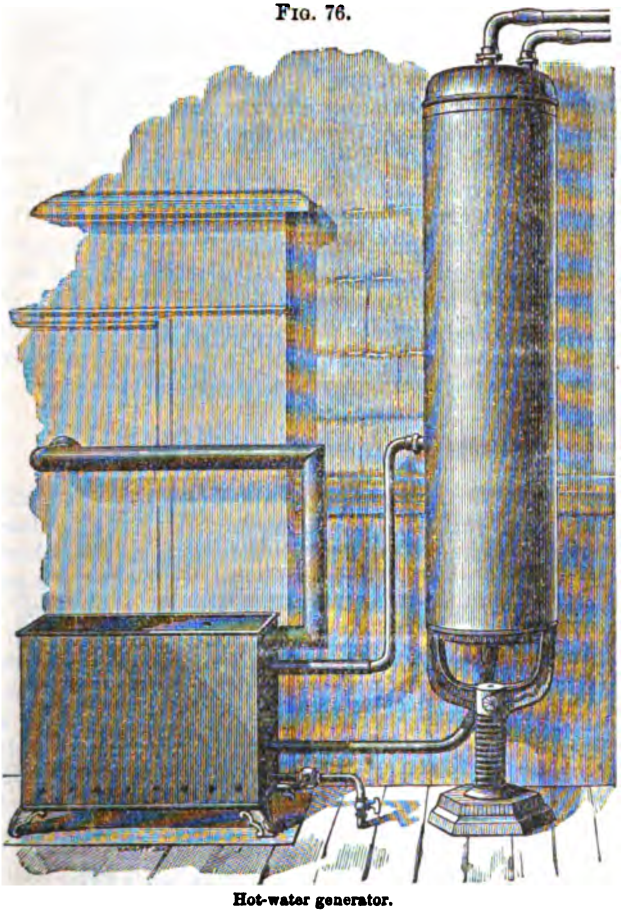
FIG. 75.



Water-heater.

in a good gas stove are—1, a smokeless flame; 2, a strong, firm, indestructible frame that will easily support a large or small vessel and is not easily overturned; 3, an easy and quick adjustment, whereby either a strong, well-sustained heat or a low, diffused heat may be obtained. Prof. Parrish devised a pharmaceutical stove which had these qualifications, but it is not made at present. Fig. 74 shows the gas stove known

FIG. 76.



Hot-water generator.

in commerce as the Economy furnace. It is made by the American Meter Company, and of all of the gas stoves that have been used by the author, this is the one which is in every way most suited for pharmaceutical operations. It has a broad, low, strong base, and cannot be easily overturned, and a double ring burner, so arranged that either the small ring or both the small and large rings may be used. As it is only about four inches high, when placed upon the laboratory counter a vessel which is upon it and being heated is not elevated so that it cannot be conveniently stirred. It is nine inches square, and its consumption of gas when both rings are lighted is ten feet per hour.

One of the greatest conveniences that a pharmacist can have at a dispensing counter, where a large supply of hot water cannot be had from a boiler, is the water-heater shown in Fig. 75. If hot water is desired, the pipe at the top is connected with a hydrant, the water turned on, and the gas-burner lighted below; in a few seconds warm water, and in a minute or two hot water, will run from the lower pipe. Fig. 76 shows a convenient hot-water generator, well adapted for furnishing a supply of hot water in pharmacies which have not access to the water back of a range, but can use gas. It is shown in the illustration attached to an ordinary circulating boiler, and it can be depended upon to furnish a large quantity of warm water. It is made by the American Meter Company.

The advantages of the use of illuminating gas as a source of heat may be summed up as follows: 1. It may be made to furnish a clean, smokeless flame. 2. It is cheap when compared with alcohol and other sources of heat, and is particularly economical in large cities. 3. The supply is unremitting, and the inconvenience of continually supplying fuel, which is always present in other forms of stoves, is not experienced here. 4. The supply is under almost perfect control, and, after once regulating the flow suitable for a continuous operation, little apprehension need be felt, during the operator's enforced absence, of an injurious rise or fall in the temperature.

METHODS OF MEASURING HEAT.

To measure degrees of temperature in pharmaceutical operations thermometers are used exclusively. A thermometer may be described as an instrument consisting of a glass tube having a capillary bore, with a cylindrical or globular bulb blown at the end, the bulb and a part of the stem containing a liquid (usually mercury), and the tube being mounted upon a graduated scale, or the tube itself graduated, in order to measure the degree of expansion of the liquid when subjected to the influence of heat. Unfortunately, the value of the degrees of thermometers in common use is not the same, there being no less than three arbitrary scales,—Centigrade, Fahrenheit, and Réaumur, the latter rarely used.

The *Centigrade*, or Celsius's, scale is best adapted for scientific work; it is given the first place in the U.S. Pharmacopœia, 1890. The freezing-point of water is zero, 0°, and the boiling-point is 100°; the intervening space is divided into one hundred equal parts (see Fig. 78).

The *Fahrenheit* scale is much the most largely used in this country and Great Britain, and until the 1880 revision of the U.S. Pharmacopœia it was used exclusively in pharmacy. The Centigrade degrees in the Pharmacopœia are followed by those of Fahrenheit enclosed in parentheses, as 100° C. (212° F.). In Fahrenheit's thermometer the freezing-point is 32°, and the boiling-point is 212°, the intervening space being divided into one hundred and eighty equal parts (see Fig. 79). In Réaumur's thermometer the freezing-point is 0°, and the boiling-point is 80°.

In Figs. 81, 82, and 83 the three thermometers are shown together to facilitate comparison: the lowest figures indicate the freezing-points of each, the highest the boiling-points.

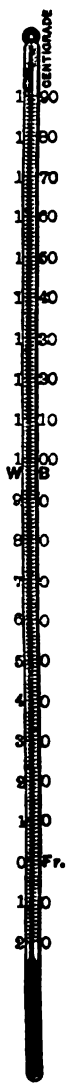
Rules.

1. *To convert Centigrade degrees into those of Fahrenheit*, multiply by 1.8 and add 32.

2. *To convert Fahrenheit degrees into those of Centigrade*, subtract 32 and divide by 1.8.

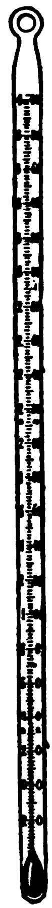
Choice of Thermometers.—It is important that the practical pharmacist should possess a good thermometer. The best form is one in which the graduations are made on the surface of the tube. The diameter of the instrument should be the same throughout its entire length; this permits its convenient use through perforated corks in distillations and other operations where it is necessary to observe temperature, and it is not so easily broken (see Fig. 79). The thickness of the glass of the bulb is not a matter of indifference: if too thick, the thermometer will not respond quickly to changes of temperature, whilst if too thin, the risk of fracture is very great. The bore of the tube should be flat or elliptical, and perfectly uniform throughout. The absence of air in the tube may be known by the descent of the mercury to the lowest part of the tube when the

FIG. 78.



Centigrade thermometer.

FIG. 79.

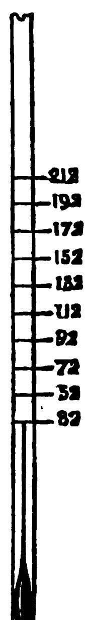


Fahrenheit thermometer.

FIG. 80.

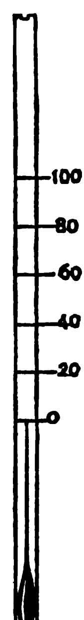
Paper-scale thermometer.

FIG. 81.



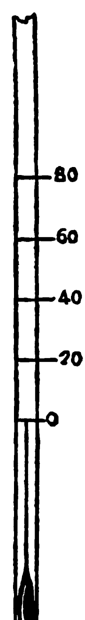
Fahrenheit thermometer.

FIG. 82.



Centigrade thermometer.

FIG. 83.



Réaumur thermometer.

thermometer is inverted. A strip of opaque, white enamelled glass behind the bore of the tube is of great assistance in reading the indication

quickly. A cheaper thermometer, which will answer for many purposes, has a paper scale inside of a glass tube (see Fig. 80). These should not be used for temperatures over 300° F., as in time the paper becomes charred. It is a good practice to send a thermometer to be officially tested,[1] and then to reserve it as a standard for correcting ordinary instruments. As glass usually reaches its limit of contraction in three years, such a thermometer should be at least this old before it is sent.

Table of Melting-Points of Official Substances.

Acidum Aceticum Glaciale	15° C.	=	59° F.
Oleum Theobromatis	30°–33° C.	=	86°–91.4° F.
Sodii Carbonas	32.5° C.	=	90.5° F.
Sodii Sulphas	33° C.	=	91.4° F.
Acidum Carbolicum (crystals)	35° C.	=	95° F.
Ferri Chloridum	35.5° C.	=	96° F.
Adeps	38°–40° C.	=	100.4°–104° F.
Adeps Lanæ Hydrosus	40° C.	=	104° F.
Sodii Phosphas	40° C.	=	104° F.
Petrolatum Molle	40°–45° C.	=	104°–113° F.
Salol	42°–43° C.	=	107.6°–109.4° F.
Menthol	43° C.	=	109.4° F.
Phosphorus	44° C.	=	111.2° F.
Petrolatum Spissum	45°–51° C.	=	113°–125° F.
Cetaceum	50° C.	=	122° F.
Sodii Hyposulphis	50° C.	=	122° F.
Thymol	50°–51° C.	=	122°–123.8° F.
Quinina	57° C.	=	134.6° F.
Chloral	58° C.	=	136.4° F.
Sodii Acetas	60° C.	=	140° F.
Cera Flava	63°–64° C.	=	145.4°–147.2° F.
Cera Alba	65° C.	=	149° F.
Acidum Stearicum	69.2° C.	=	156.6° F.
Potassii et Sodii Tartras	74° C.	=	165.2° F.
Camphora Monobromata	76° C.	=	168.8° F.
Hyoscyaminæ Hydrobromas	78° C.	=	172.4° F.
Naphtalinum	80° C.	=	176° F.
Quininæ Valerianas	90° C.	=	194° F.
Alumen	92° C.	=	197.6° F.
Resorcinum	100°–119° C.	=	230°–246.2° F.
Physostigminæ Sulphas	105° C.	=	221° F.
Atropina	108° C.	=	226.4° F.
Iodum	114° C.	=	237.2° F.
Iodoformum	115° C.	=	239° F.
Sulphur Lotum	115° C.	=	239° F.
Sulphur Præcipitatum	115° C.	=	239° F.
Sulphur Sublimatum	115° C.	=	239° F.
Zinci Chloridum	115° C.	=	239° F.
Terpini Hydras	116°–117° C.	=	240.8°–242.6° F.
Acidum Benzoicum	121.4° C.	=	250.5° F.
Naphtol	122° C.	=	251.6° F.
Elastica	125° C.	=	257° F.
Piperina	130° C.	=	266° F.
Pyrogallol	131° C.	=	267.8° F.
Acidum Tartaricum	135° C.	=	275° F.
Acidum Citricum	135°–152° C.	=	275°–305.6° F.
Sparteinæ Sulphas	136° C.	=	276.8° F.
Hyoscyaminæ Sulphas	140°–160° C.	=	284°–320° F.
Sodii Arsenas	148° C.	=	298.4° F.
Chrysarobinum	151° C.	=	303.8° F.

[1] Thermometers are examined, and certificates are issued showing the corrections, by Winchester Observatory of Yale College, New Haven, Conn.

Quininæ Hydrobromas	152°–200° C.	=	305.6°–392° F.
Codeina	155° C.	=	311° F.
Acidum Salicylicum	157° C.	=	314.6° F.
Hyoscinæ Hydrobromas	160° C.	=	320° F.
Ammonii Nitras	165°–166° C.	=	329°–330.8° F.
Santoninum	170° C.	=	338° F.
Hydrastininæ Hydrochloras (melting partially)	173° C.	=	343.4° F.
Camphora	175° C.	=	347° F.
Veratrina	175° C.	=	347° F.
Physostigminæ Salicylas	179° C.	=	354.2° F.
Atropinæ Sulphas	187° C.	=	369° F.
Quininæ Hydrochloras	190° C.	=	374° F.
Acidum Chromicum	192° C.	=	377.6° F.
Cocaina	193° C.	=	379.4° F.
Pilocarpinæ Hydrochloras	197° C.	=	386.6° F.
Salicinum	198° C.	=	388.4° F.
Alumini Sulphas	200° C.	=	392° F.
Argenti Nitras	200° C.	=	392° F.
Picrotoxinum	200° C.	=	392° F.
Plumbi Acetas	200° C.	=	392° F.
Strychninæ Sulphas	200° C.	=	392° F.
Elaterinum	209° C.	=	408.2° F.
Cinchoninæ Sulphas	215° C.	=	419° F.
Acidum Gallicum	222° C.	=	431.6° F.
Caffeina	229° C.	=	444.2° F.
Potassii Chloras	234° C.	=	453.2° F.
Hydrargyri Iodidum Rubrum	238° C.	=	460.4° F.
Cinchonina	240° C.	=	464° F.
Morphina	254° C.	=	489.2° F.
Morphinæ Sulphas	255° C.	=	491° F.
Hydrargyri Chloridum Corrosivum	265° C.	=	509° F.
Strychnina	268° C.	=	514.4° F.
Potassii Acetas	292° C.	=	557.6° F.
Sodii Nitras	312° C.	=	593.6° F.
Potassii Nitras	353° C.	=	667.4° F.
Zinci Bromidum	394° C.	=	741.2° F.
Argenti Iodidum	400° C.	=	752° F.
Zincum	412°–415° C.	=	773.6°–779° F.
Zinci Iodidum	446° C.	=	834.8° F.
Soda	525° C.	=	977° F.
Potassa	530° C.	=	986° F.
Calcii Bromidum	680° C.	=	1256° F.
Potassii Bromidum	700° C.	=	1290° F.

QUESTIONS ON CHAPTER II.

OPERATIONS REQUIRING THE USE OF HEAT.

According to the dynamical theory, how is heat produced?
What solids are commonly used as fuels in developing heat?
What is the objection to using wood as a source of heat in pharmaceutical operations?
Is charcoal more or less convenient, and why?
What advantage has anthracite coal?
What is the objection to bituminous coal?
How is water heated in an ordinary range?
What liquids are used for heating purposes in pharmaceutical operations?
What objection is there to the use of alcohol?
What is the arrangement of the so-called Russian blast-lamp?
How may benzin or gasolin be burned without danger from explosion?
Is kerosene or coal oil safer than gasolin? If so, why?

Does coal oil require a wick to burn satisfactorily?

What is the disadvantage of using a wick?

Of what does ordinary illuminating gas consist? How is it produced?

What valuable liquid and solid by-products are obtained in process of manufacture?

Give an explanation of the three zones that are apparent in an ordinary gas-flame.

How may ordinary gas be burned so as to become a source of heat rather than of light?

What is a Bunsen burner?

What is the objection to the ordinary Bunsen burner?

How may this be obviated?

How does the length of the perpendicular tube affect the smokeless character of the flame?

Describe Fletcher's radial burner.

What are the chief points to be secured in a good gas stove?

Describe the Economy furnace.

What are the chief advantages in this stove?

What are the advantages of the use of illuminating gas as a source of heat?

In pharmaceutical operations, how are degrees of temperature measured?

What is a thermometer?

What three scales of degrees of heat for thermometers are used?

Which is most largely used in this country?

Which is used in the U. S. Pharmacopœia?

What are the freezing- and boiling-points of Fahrenheit's scale?

How is the intervening space divided?

What are the freezing- and boiling-points of the Centigrade scale?

How is the intervening space divided?

What are the freezing- and boiling-points of Réaumur's scale?

How is the intervening space divided?

How may Centigrade degrees be converted into those of Fahrenheit above 32?

How may Fahrenheit degrees above 32 be converted into Centigrade degrees?

What are the essential points of a good thermometer?

Convert —13.72° C. into F.

—13.72
1.8
10976
1372
—24.696
+32
8.696

Convert —27.4° F. into C.

—27.4
—32
1.8) —59.4 (—33
54
54
54

Convert —5° C. into F

—5
1.8
—9.0
+32
23.

Convert —2.2° F. into C.

—2.2
—32
1.8) —34.2 (—19
18
162
162

Convert 78° C. into F.

78
1.8
624
78
140.4
32
172.4

Convert 62° F. into C.

62
32
1.8) 30 (16.66
18
120
108
12

CHAPTER III.

USES OF HEAT.

THE consideration of the uses of heat in pharmacy will follow naturally the preceding chapter upon its generation and measurement, and the subject may be properly treated of under two classes,—viz.: 1, those operations in which comparatively high temperatures are required, and, 2, those which require moderate or low temperatures. It will be readily noticed that the latter class will embrace nearly all of the more important pharmaceutical operations in which heat is employed.

Operations in which comparatively High Temperatures are required.—In this class of operations must be placed some which seem to be in danger of becoming lost arts through the growth of special methods, which are now conducted on a large scale by manufacturers, who supply the products of their skill so cheaply that the home-made apparatus is often produced at a pecuniary loss. It will, nevertheless, be found useful to refer briefly to these operations, for a certain amount of knowledge will frequently be of service to the practical worker in emergencies and on special occasions.

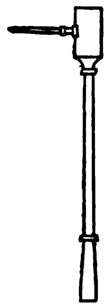
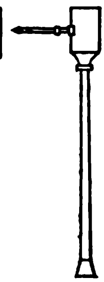
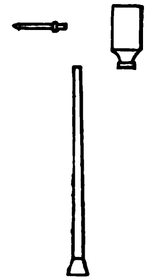
The Use of the Blow-Pipe.—A blow-pipe in its simplest form is a metallic tube, usually of brass or copper, slightly conical, gradually tapering to a minute orifice, the narrowest portion being curved so that the axis of the orifice is at right angles to that of the principal portion of the tube. It is used by placing the widest end in the mouth, and inserting the other end into the edge of the flame, and forcing a current of air through the tube, with the effect of increasing the intensity of the flame by converting it into a miniature blast. Some skill and practice are required to produce an unremitting current of air, and this is effected by keeping the muscles of the cheeks distended and constantly supplying air from the lungs as it is needed. When the blow-pipe is used with a luminous flame, the interior of the flame, owing to the carbon not being wholly oxidized, has the power of deoxidizing or reducing oxides, whilst the outer flame has opposite or oxidizing properties: a piece of lead glass tube held in the inner flame will be blackened through the reduction of the lead oxide to the metallic state; if this stain is held in the outer flame the metal is reoxidized, dissolves in the glass, and the glass again becomes transparent. The blow-pipe is useful in pharmacy in working and bending glass, in testing fusible chemical substances, in soldering apparatus, etc. The various forms of blow-pipes in common use are shown in Figs. 86 to 91.

The Fletcher's gas blow-pipe, shown in Fig. 92, furnishes an excellent and very powerful blast which is capable of delicate adjustment. It

has a universal ball-and-socket joint, which enables it to be used in any position. The very convenient foot-bellows, shown in Fig. 93, may be used in connection with it for producing the blast. The sides of this

FIG. 86. FIG. 87. FIG. 88. FIG. 89. FIG. 90. FIG. 91.



Plain blow-pipe. Bulb. Black's. Berzelius's. Plattner's. Plattner's (dissected).

bellows are of stout leather, and the reservoir of air beneath is obtained by stretching and fastening a circular piece of thin rubber cloth over the lower orifice and preventing too great expansion and rupture by enclosing it in a net: this form, with the reservoir below, is preferable to that formerly in use, which had the rubber cloth above; the advantages are greater protection against injury from falling

FIG. 92.

Gas blow-pipe.

FIG. 93.

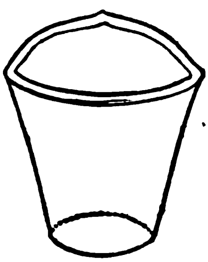
Foot-bellows.

articles, and less obstruction to the valves through sucking in dust from the floor.

Crucible Operations.—A crucible is a cup-shaped vessel made of platinum, silver, black lead, iron, porcelain, wedgwood-ware, or clay, and intended to withstand a very powerful heat. It is used for fusing metals or heating metallic oxides or organic substances, and is very useful in chemical analysis. The Hessian crucible (see Fig. 94) is the cheapest: it is unfitted for delicate operations, for, although capable of withstanding great heat, its porous character permits the ready absorption of many substances. The black-lead crucible is more expen-

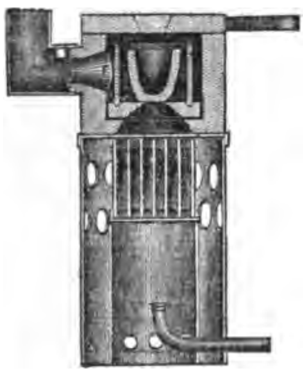
sive: it is less porous, is infusible, and has the great merit of bearing great changes in temperature without risk of fracture. Porcelain or wedgwood crucibles are fragile, and have to be very gradually cooled to prevent breakage. Fletcher's gas crucible furnace (see Fig. 95) is very useful in this connection. Of the metals used in making crucibles,

Fig. 94.



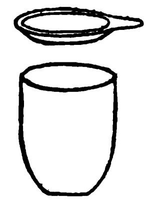
Hessian crucible.

Fig. 95.



Crucible furnace.

Fig. 96.



Platinum crucible.

platinum is superior to any: its well-known power of resisting fusion, its cleanliness, and its non-liability to be acted upon by most chemical substances render it invaluable to the chemist, notwithstanding its costliness (see Fig. 96).

The following processes require the application of high heat:

1. *Ignition*, in the sense in which it is used in the Pharmacopœia and by chemists generally, is the process of strongly heating solid or semi-solid substances, the residue left at the conclusion of the process being the object sought. The U. S. 1890 quantitative tests for potassium bitartrate, sodium benzoate, and purified antimony sulphide afford examples of the use of this process.

2. *Fusion* is the process of liquefying solid bodies by the application of heat without the use of a solvent: the melting of wax, and the preparation of moulded silver nitrate, are familiar examples of this process.

3. *Calcination* is the process of separating volatile substances from fixed inorganic matter by the application of heat without fusion: its principal application in pharmacy is in the expulsion of water and carbonic acid from carbonates, as shown in the processes for making magnesia, lime, etc.

4. *Deflagration* is the process of heating one inorganic substance with another capable of yielding oxygen (usually a nitrate or a chlorate); decomposition ensues, accompanied by a violent, noisy, or sudden combustion. Deflagration is used in making some of the salts of antimony and arsenic, and in some qualitative analytical examinations.

5. *Carbonization* is the process of heating organic substances *without* exposure to air until the volatile products are driven off, and the residue assumes the black color characteristic of free carbon or charcoal. The manufacture of bone-black and wood charcoal affords good illustrations.

6. *Torrefaction* (known also as roasting) is the process whereby organic substances have some of their constituents modified by the application of a degree of heat somewhat less than that necessary to carbonize them. The most familiar example of this process is the roasting of coffee. Rhubarb in coarse, dry powder, when subjected to this process, loses its cathartic properties, but retains its astringent qualities, and is known as *Torrefied Rhubarb.*

7. *Incineration* is the process of heating strongly, organic substances *with* access of air until all the carbon is consumed, the ashes which remain being the object sought. The process is frequently used in analysis to determine the amount of fixed matter in an organic substance.

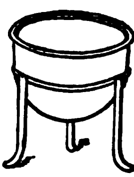
8. *Sublimation* is the process of separating a volatile solid substance from one which is not volatile by the application of heat. A special chapter on this subject will be found in the succeeding pages.

OPERATIONS REQUIRING HEAT IN WHICH LOWER TEMPERATURES ARE USED.

In this class of operations will be found the most important of those requiring the application of heat; almost all medicinal substances have their properties altered by the action of heat, and many cases are met with where it is necessary to moderate carefully the heat in order to prevent the decomposition or destruction of the active agent; for the purpose of controlling heat various baths are used, as the sand-bath, oil-bath, solution-bath, steam-bath, water-bath, etc.

The sand-bath is usually an iron vessel of hemispherical or other convenient shape, containing dry, clean sand (see Fig. 97); the vessel to be heated is embedded in the sand, and the bath is then heated to the required degree. The object of this form of bath is to equalize the temperature, and to prevent a too sudden rise or fall of heat whereby unequal expansion or contraction might cause fracture to a glass or porcelain vessel being heated. Iron-wire clippings have sometimes been substituted for sand, with doubtful advantage, however.

FIG. 97.



Sand-bath.

The practical error usually made by inexperienced operators in the use of the sand-bath is in permitting too large a body of sand to rest between the bottom of the vessel to be heated and the flame; this results in an unnecessary waste of heat.

The oil-bath is designed to furnish a regulated temperature below 260° C. (500° F.). A fixed oil is the medium usually employed for communicating the heat, but one of the best substitutes for oil is petrolatum. Most fixed oils, when heated above 177° C. (350° F.), evolve disagreeable fumes.

In fractional distillation on a large scale, oil-baths are often used to control temperature, and the fumes arising from the heated oil are carried off by a pipe to the chimney.

The glycerin-bath.—In order to avoid the disagreeable odors arising from hot oil, glycerin is sometimes substituted. Acrolein, an acrid, volatile product, however, is produced if glycerin is heated nearly to

boiling. A temperature of 250° C. (482° F.) can be maintained in a glycerin-bath without much inconvenience.

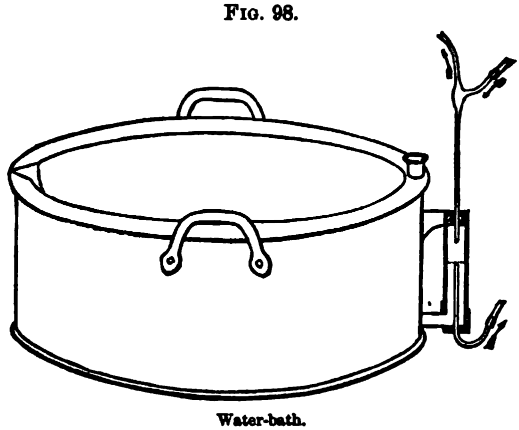
Salt-water baths are sometimes used in special operations; their principle of action depends on the fact that the boiling-point of a liquid is raised in proportion to the quantity of fixed salt dissolved in it. Water, as is well known, boils at 100° C. (212° F.), but if common salt is dissolved in water until it ceases to take up any more, and a saturated solution is produced, it is found that this solution does not boil until the temperature of 108.4° C. (227.1° F.) is reached. The following table shows the boiling-point of certain saturated solutions as determined by Legrand and others:

Table of Boiling-Points of Saturated Solutions of various Salts.

Salt.	Boiling-Point.		Salt.	Boiling-Point.	
	C.	F.		C.	F.
Sodium Chloride	108.4°	227.1°	Sodium Acetate	124.4°	256°
Ammonium Chloride . . .	114.2°	237.6°	Potassium Carbonate . . .	135°	275°
Potassium Tartrate . . .	114.7°	238.5°	Calcium Nitrate	151°	303.8°
Potassium Nitrate	115.9°	240.2°	Potassium Acetate	169°	336.2°
Sodium Nitrate	121°	249.8°	Calcium Chloride	179°	354.2°

The water-bath is one of the most useful of all the forms of pharmaceutical apparatus for regulating temperature, and the frequency with which it is directed to be used in works of authority indicates its importance as a necessary implement in the equipment of every pharmaceutical laboratory. Almost all the water-baths used by pharmacists are extemporized, and these are generally crude and inconvenient; two dishes usually suffice, one of them somewhat larger in diameter than the other. Water is poured into the larger dish, and the other dish, containing the liquid to be heated, is placed in the water and the heat applied; the room is soon filled with the escaping steam, and in winter the condensation of the moisture upon the windows is alone a sufficient inconvenience to render it undesirable. Fig. 98 shows a tinned copper water-bath in which this annoyance is overcome. The water-level has at its lowest point a piece of block-tin tube soldered in; this extends half-way up the glass tube in the inside, whilst a perforated cork at the upper end of the glass tube permits the insertion of another piece of block-tin tube; the upper

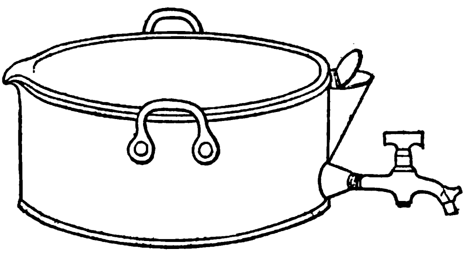
FIG. 98.



Water-bath.

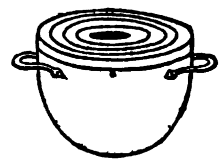
tube connects with the cold-water faucet and terminates in the smoke-flue or with the outside air; the vapor arising from the boiling water either passes off into the chimney, as shown by the arrow, or is condensed, the loss being supplied by a small stream of water from the cold-water faucet, shown by the arrow pointing downward; the lower block-tin tube acts as an overflow, the excess of water being carried off by a rubber tube into the sink; all possibility of the water-bath "boiling dry" is thus obviated. Vapors from the liquid in the water-bath may be carried off by a hood (see Fig. 129). A simple water-bath may be made by encasing a tinned-copper round-bottomed dish in one of larger diameter having a flat bottom. Water is poured in through a tubulure in the top, and it is replenished as required. Fig. 99 shows a similar water-bath, a porcelain evaporating dish taking the place of the copper one. It is useful where a metallic dish would be acted on by the substance to be heated.

FIG. 99.



Water-bath (porcelain dish).

FIG. 100.



Water-bath (copper ring).

A water-bath intended for the smaller operations of analytical chemistry is shown in Fig. 100. The different sizes of the rings render it convenient for vessels of various shapes and sizes. It will be necessary to allude frequently hereafter to the uses and modifications of the water-bath.

THE USE OF STEAM IN PHARMACEUTICAL OPERATIONS.

The scope of this work will not permit of any extended consideration of the use of steam in technical pharmacy, yet it is of vital interest to be acquainted not only with the theories underlying its employment, but also with the apparatus used in its practical application.

When water is heated to the boiling-point and steam is produced, a certain amount of heat is absorbed (or apparently lost): this has been termed *latent heat.* When steam comes in contact with surfaces having less heat than itself, it is condensed, water is produced, and the latent heat becomes *sensible* (or reappears), thus proving the well-established physical law that *when a liquid assumes the gaseous state, a certain fixed and definite amount of heat disappears; and, conversely, when a gas or vapor becomes a liquid, heat to a corresponding extent is evolved.* Watts has illustrated this as follows: "When water at 0° C. is mixed with an equal weight of water at 100° C., the whole is found to have the mean of the two temperatures, or 50° C. On the other hand, 1 part by weight of *steam* at 100° C., when condensed in cold water, is found to be capable of raising 5.4 parts of the latter from the freezing-point to the boiling-

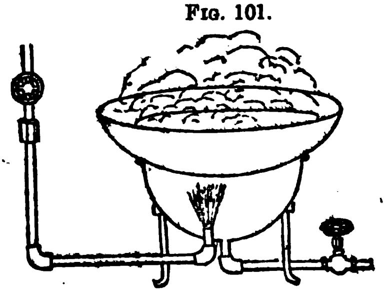
point, or through a range of 100° C. Now, $100 \times 5.4 = 540$; that is to say, steam at 100° C. in becoming water at 100° C. parts with enough heat to raise a weight of water equal to its own (if it were possible) 540° of the Centigrade thermometer, or 540 times its own weight of water one degree of the same." When water passes into steam the same quantity of sensible heat becomes latent. A consideration of these facts in physics leads to the practical application of steam as a transmitter of heat, whereby heat from any source may be absorbed by steam and carried through suitable pipes to the vessel designed to be heated. If this vessel is filled with a cold liquid, the latent heat of the steam is rapidly communicated to the liquid, the steam is condensed, and the result is this most convenient and economical method of producing a temperature which is capable of being regulated with great exactness.

Steam-baths may be divided into two classes: 1, those in which steam is used without pressure; and, 2, those in which steam is used under pressure.

1. *The use of Steam without Pressure.*—In many cases open steam, as it is termed, is used (see Fig. 101). The pipe which conveys the steam from the boiler is conducted to the bottom of a hemispherical kettle, and the liquid to be heated is poured into a dish of larger diameter, which is placed upon the top; the steam is turned on, and as it condenses is carried off by the drip-pipe. A temperature of about 100° C. (212° F.) can usually be maintained by this method.

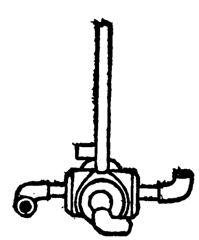
Sometimes the steam-pipe is conducted directly from the top into the liquid to be heated. A steam-distributor, as shown in Fig. 102, may be used at the end of the pipe near the bottom of the kettle; it is made by screwing a cross upon the end of the pipe, and an elbow to each arm

FIG. 101.



Open steam-bath.

FIG. 102.



Steam-distributor.

of the cross; the steam issues usually with some force from each elbow and effectually stirs up the liquid, and rapidly produces a uniform temperature in it. The principal disadvantages about using steam in this way are the noise at first produced by the contact of the hot steam with the cold liquid, and the increase in bulk of the liquid through the condensation of the steam.

2. *The use of Steam under Pressure.*—This is by far the most convenient method of using steam practically as a means of transmitting heat. It has been stated that steam produced in open and unconfined vessels, with the ordinary pressure of the atmosphere, has the temper-

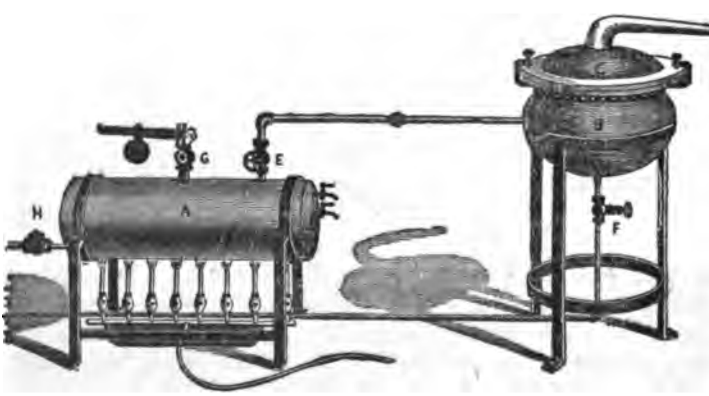
ature of 100° C. (212° F.). If water is heated continuously in a boiler capable of withstanding pressure, the water is prevented from boiling by the pressure of its own vapor, and the temperature of the steam rises in proportion as the pressure increases. It is usually stated that the pressure of the atmosphere is 14.7 pounds to the square inch. The following table shows the increase in temperature of steam when the pressure exceeds that of the atmosphere. Of course the opposite effect is produced when the pressure is removed, and the water boils below the temperature of 100° C. (212° F.). (See vacuum apparatus.)

Table of the Temperatures of Superheated Steam.

PRESSURE.	Temperature of Steam.		PRESSURE.	Temperature of Steam.	
Pounds per Square Inch.	C.	F.	Pounds per Square Inch.	C.	F.
14.7	100°	212°	55	141.6°	287.1°
17	104.2°	219.6°	60	144.7°	292.7°
20	108.8°	228°	65	147.7°	298°
23	113°	235.5°	70	150.5°	302.9°
25	115.6°	240.1°	75	153°	307.5°
30	121.3°	250.4°	80	155.5°	312°
35	126.2°	259.3°	85	157.8°	316.1°
40	130.7°	267.3°	90	160°	320.2°
45	134.6°	274.4°	95	162.2°	324.1°
50	138.3°	281°	100	164.4°	327.9°

The principle of the use of steam under pressure is shown in the apparatus (see Fig. 103). It was designed by the author in 1872 to illustrate the subject practically upon the lecture-table. A cylindrical copper boiler, A, supported by a stout iron stand, is heated by a row of six

FIG. 103.



Use of steam under pressure.

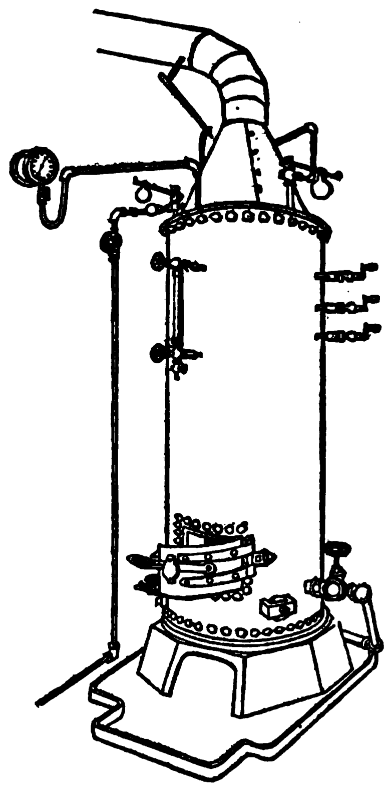
Bunsen burners; water is forced into the boiler from the hydrant through a rubber hose attached to the pipe connected with the check-valve, H. The steam passes into the jacketed kettle, B, and is controlled by the

steam-valve, E, the exhaust steam and condensed water passing through the pipe controlled by the valve F.

An upright tubular steam boiler, suited to operations in the pharmaceutical laboratory, and a sectional view of the same, are shown in Figs. 104 and 105.

Prof. Patch has contrived a very convenient upright tubular steel boiler, shown in Fig. 106. It is covered with asbestos composition, which acts as a non-conductor of heat, and the source of heat is a large coal-oil

Fig. 104.



Steam boiler.

Fig. 105.

Steam boiler (sectional view).

stove; a conical coil of pipe serves to support a funnel when hot filtration is needed, whilst a safety-valve and steam-gauge assure safety. It is, of course, intended only for the laboratory of a retail druggist.

The usual form of steam kettle is shown in Fig. 107. A copper pan, tinned inside, having flaring sides to facilitate evaporation, is securely connected about midway from the bottom with another copper pan, both being riveted together. An opening for the steam-pipe is made in the jacketed side to admit steam, and at the lowest point of the bottom another pipe is attached to carry off the water which is produced by the condensation of the steam. The upper edge of the kettle is protected by a flat brass ring, which is soldered and riveted to it, and which also

serves to support the still-top when the steam kettle is used for distillations. (See chapter on distillation.) Care should be exercised to have the bottom of the kettle made of copper heavy enough to resist the greatest amount of steam-pressure that will be likely to be used on it, as instances have been known of collapse when this was neglected. In using the steam kettle, the liquid that is to be heated is run into it by a syphon or other means; the drip- or exhaust-cock below is opened partially, and the steam slowly turned on. The habit of opening steam-valves cautiously is one that should be sedulously cultivated, as accidents and strains to steam apparatus often arise from the sudden shocks due to want of care in this respect. While the liquid is becoming heated, the condensed water should be allowed to escape freely, and when the proper temperature is reached, the steam-valve should be carefully adjusted and the exhaust-valve turned so that, whilst all the condensed water may escape, no steam shall

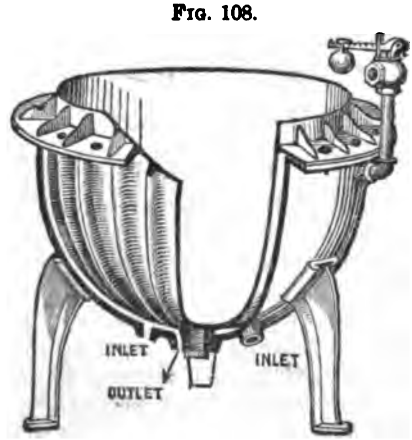
FIG. 106.

Patch's steam boiler.

FIG. 107.

Steam kettle.

FIG. 108.

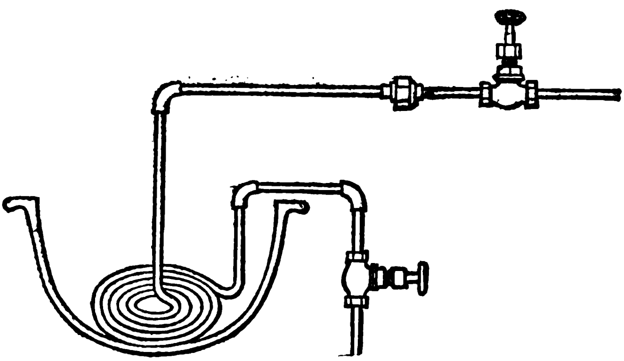


Enamelled steam kettle.

be allowed to go to waste by its being opened too widely. One of the

greatest objections to the use of tinned-copper kettles is that the coating of tin soon wears off, and contamination of the extract or liquid with copper is almost sure to result. The enamelled cast-iron kettle made by Barrows, Savery & Co., of Philadelphia, shown in Fig. 108, is to be preferred on this account, although the injurious cracking of the enamel from overheating and the resulting exposure of the liquid to the iron surface beneath is an objection. It is proper to state that with care the

FIG. 109.

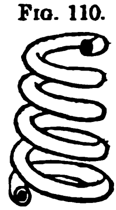


Steam coil.

enamel may often be retained for years in perfect condition. Jacketed iron tanks lined with sheet block-tin are very useful and durable, but their costliness is apt to prevent their extended use.

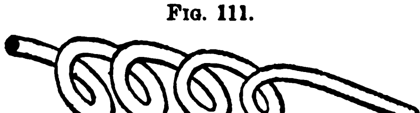
Pressure steam is frequently passed through coils of iron, block-tin, or lead which have been immersed in the liquid to be heated. Fig. 109 shows the usual form. It will be found very useful to the practical worker to use block-tin pipe. Steam-valves may be soldered to both ends of the pipe, and on account of the flexibility of the pipe it may be readily adjusted and coiled to suit available space, whilst the absence of danger from contamination when used for heating most medicinal liquids is an advantage which should not be overlooked. Steam, when

FIG. 110.



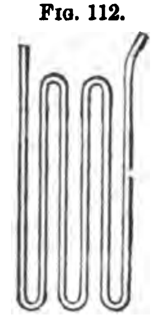
Upright steam coil.

FIG. 111.



Horizontal steam coil.

FIG. 112.



Zigzag steam coil.

passed through coils of various shapes, zigzag pipes, etc., is also largely used in heating liquids in special operations, in drying drugs, chemicals, etc. Figs. 110, 111, and 112 illustrate these forms. (See also chapter on desiccation.)

QUESTIONS ON CHAPTER III.

USES OF HEAT.

What is a blow-pipe, and how is it used?
What is it used for?
How is Fletcher's gas blow-pipe arranged?
What is the construction of a foot-bellows?
What is a crucible, and what is its use?
Of what materials are crucibles made?
What sort will bear great heat without danger of breaking?
What is the best metal from which to make crucibles, and why?
What processes require the application of high heat?
What is ignition? Give an example of ignition.
What is fusion? Give an example of an official preparation in which this process is used.
What is calcination?
What is deflagration?
What is carbonization? Give an illustration.
What is torrefaction? Give an illustration.
What is incineration?
What is sublimation?
In operations requiring lower temperature, what contrivances are used for controlling the heat?
What is a sand-bath?
What is an oil-bath?
What temperature does an oil-bath furnish?
What temperature does a glycerin-bath furnish?
What temperature does a salt-water bath furnish?
What is a water-bath?
What is latent heat?
When water at 0° Centigrade is mixed with an equal weight of water at 100° Centigrade, what is the temperature of the mixture?
How much water will 100 parts (by weight) of steam raise from the freezing-point to the boiling-point?
What temperature can be obtained by an open steam-bath?
What is the pressure of the atmosphere to the square inch?
If water be heated continuously under pressure, what will be the result?
Describe an upright tubular steam boiler.
What is the objection to using tinned-copper steam kettles?
What is the objection to using enamelled cast-iron steam kettles?

CHAPTER IV.

VAPORIZATION.

UNDER this head will be included those pharmaceutical operations in which volatile substances are separated from fixed bodies, or from others which are less volatile, by the action of heat at varying temperatures. Vaporization is frequently employed in pharmacy, and it will be most convenient to consider its applications in the order of their importance: 1. To Liquids. 2. To Solids.

1. When vaporization is used to separate a *volatile liquid* from a *less volatile* liquid, it is called *evaporation.*

2. When the object sought is the *volatile liquid*, it is called *distillation.*

3. When it is used to separate a *volatile liquid* from a *solid*, it is called *desiccation*, *exsiccation*, or *granulation.*

4. When it is used to separate a *volatile solid* from another body, it is called *sublimation.*

The following diagram may serve to impress the definitions on the memory:

Vaporization.

Object Sought.	Process.
Liquids:	
Fixed or less volatile	Evaporation.
Volatile	Distillation.
Solids:	
Fixed	Desiccation. Exsiccation. Granulation.
Volatile	Sublimation.

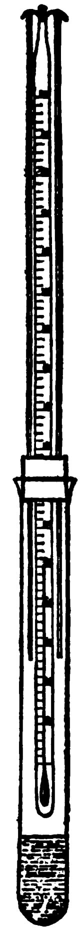
The subjects of Evaporation, Distillation, Sublimation, and Desiccation will be considered in the chapters which immediately follow. Vaporization, as applied to Granulation and Exsiccation, will be more appropriately considered after the chapters on Solution and Crystallization.

EVAPORATION.

Although this term has in its more popular sense the signification of the separation of moisture from any body, whether solid or liquid, in pharmacy the word has a more restricted meaning, and signifies the driving off of the more volatile or less valuable portions of a liquid by the application of heat, with the object of purifying it or obtaining the less volatile portion. Illustrations are found in the concentration of syrups and liquids intended for crystallization, and in the treatment of weak tinctures in making fluid-extracts and extracts.

As *ebullition*, or *boiling*, is an important form of evaporation, it will be necessary first to consider the essential points concerned therein. Ebullition in a heated liquid is caused by the formation of bubbles of vapor upon the surface of the vessel, which, rising to the surface of the liquid and bursting, permit the vapor to become diffused in the space above the boiling liquid. The *boiling-point* of a liquid may be defined as the temperature at which the tension of its vapor is equal to the pressure of the atmosphere, this point being *definite*, whilst *evaporation* takes place in the same liquid at nearly all degrees of heat, and hence the *evaporating* point is an *indefinite* temperature. The point at which a liquid boils varies with the liquid, and in the U. S. Pharmacopœia and other authoritative works the boiling-point is frequently considered an important test in establishing the identity or purity of a liquid. The table at the end of this chapter shows the boiling-point of the official liquids arranged in order, beginning with the lowest.

FIG. 113.



Boiling-point test.

The boiling-point of a liquid is affected by the cohesion of the liquid and the degree of pressure upon its surface. Water under the ordinary pressure of the atmosphere boils at 100° C. (212° F.). When confined in a steam boiler it has been shown that water can have a temperature considerably over 200° C. (392° F.) without boiling, the bubbles being prevented from rising to the top on account of the pressure of the steam in the confined space above the liquid. On the other hand, the removal of pressure causes a liquid to boil below its normal boiling-point, as will be explained in the chapter on vacuum apparatus. The character of the vessel in which a liquid is boiled has also a slight effect in modifying the boiling-point. (See Evaporation by Boiling.)

Determination of Boiling-Points.—One of the simplest methods of ascertaining the boiling-point of a liquid is illustrated in the cut (see Fig. 113). The liquid is introduced into a test-tube, and a glass tube is selected of such diameter as will permit a tube-thermometer to pass easily through it and leave a small space between; the tube should be about one inch shorter than the thermometer. A short piece of wire should be passed through the glass ring of the thermometer, and slightly bent to hold it in position; a perforated cork should now be fitted tightly to the test-tube, and the tube carrying the thermometer-tube pushed through the perforation in the cork until the bulb of the thermometer is just above the liquid; heat should be applied cautiously by a sand-bath or water-bath. The vapor from the boiling liquid passes upward through the whole length of the thermometer, escaping at the top, and thus the error common to some methods, due to the difference in temperature between the portion of the thermometer in the test-tube and that outside of the test-tube, is measurably avoided.

Tension of Vapors.—If a glass tube, thirty-six inches long, closed at one end, is filled with mercury, and the open end, after closing it

with the finger, carefully inverted in a beaker containing mercury, it will be found that the mercury will run out from the tube into the beaker until a column of mercury about thirty inches in height is left: this column is sustained by the pressure of the atmosphere, and is, in fact, the well-known mercurial barometer-tube: the six inches of space in the tube above the level of the mercury is of course empty, or vacuous. Now, if a few drops of water are passed into the tube by a dropper, they immediately rise to the level of the mercury in the tube, and, although the temperature has not been increased, a portion of the water is vaporized, and the column of mercury is proportionately depressed: this depression is due to the elasticity or tension of the aqueous vapor. If the tube be forcibly pushed down into the mercury, the increased pressure will be found to have liquefied the vapor, and the original quantity of water is recovered; but the depression in the column of mercury may be increased by heat, and when a sufficient amount of heat has been applied to the tube to expel the mercury until none is left in the tube, it will be found that the temperature marks 100° C. (212° F.), which is exactly the boiling-point of the liquid (water), showing that this point must be reached in order to overcome the pressure of the atmosphere. If alcohol or ether be substituted for water, it will be found that the mercury will be depressed in a far greater ratio,—this being due to the greater volatility and lower boiling-point of these liquids. The *maximum density* of the vapor of a volatile liquid in a confined space in contact with the corresponding liquid is reached when its elastic force attains the limit beyond which pressure produces the liquefaction of the vapor. When this limit is reached, the vapor is said to be *saturated:* maximum density varies with the temperature. If a saturated vapor in an enclosed tube is not in contact with an excess of liquid, increase of temperature lowers its density or expands it. On the other hand, when a saturated vapor is cooled, liquefaction gradually takes place, the vapor above the liquid remaining in the condition of maximum density until converted into the liquid: so that *cold* and *pressure* have the effect of *converting vapors into liquids,* whilst *heat* and the *removal of pressure* have the reverse effect,—*i.e.*, the *conversion of liquids into vapors.* The phenomena above described characterize evaporation into a space filled with air as well as evaporation into a vacuum, the only difference being that more time is required to produce the same effects when evaporating in contact with air, for volatile liquids are instantly converted into vapor in a vacuum, while the presence of air retards, but does not prevent, vaporization. A consideration of the foregoing facts leads to the following deductions:

1. The quantity of vapor that will form in a confined space depends upon the amount of pressure and heat to which the liquid is subjected; and when the point of maximum density of the vapor is reached, evaporation ceases if the pressure and temperature remain the same.

2. The rapidity of evaporation of an aqueous liquid in the open air is influenced by the condition of the aqueous vapor always present in the air. If it has the greatest density possible for the degree of heat, evaporation is retarded; but if the aqueous vapor in the atmosphere

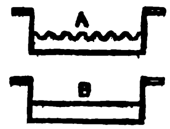
is much below the state of maximum density, as is usually the case, evaporation is promoted.

3. Rapidity of evaporation is increased by removing the pressure of the atmosphere.

4. Increase of temperature obviously accelerates evaporation, by increasing the formation of vapor.

Evaporation of Liquids by Boiling.—In evaporating *by boiling*, temperature, pressure, etc., being equal, the rapidity of the process depends upon the *extent of surface exposed to the heat*. Fig. 114 represents a profile view of two evaporators, A and B. The corrugated bottom of A gives twice as much surface as the smooth bottom of B, and hence if the same quantity of a liquid is made to boil in each, at the same temperature, the bubbles of vapor given off from the corrugated bottom will be twice as numerous as those formed on the plain bottom. The superiority of tubular boilers over the ordinary plain or Cornish boiler also affords a good illustration of this fact (see Fig. 105).

FIG. 114.



Evaporation by boiling.

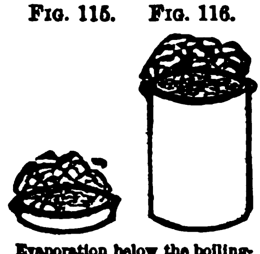
When a pure, volatile liquid is heated to the boiling-point in the open air, its temperature remains the same until the whole of the liquid has evaporated. If, on the other hand, solid matter is dissolved in the liquid, the temperature of the solution is gradually increased until saturation is reached: this fact is well illustrated by considering boiling-points of saturated solutions of various salts (see page 127), and it shows the importance of diminishing the heat in the evaporation of solutions of organic substances as evaporation progresses, as, for example, in the making of extracts, etc.

The cohesion of a liquid affects its boiling-point, dense, thick, and sticky liquids offering more resistance to the escape of the bubbles of vapor than rare, mobile, or thin liquids.

The relative depth of liquid also influences the boiling-point. Shallow vessels favor ebullition, because they afford proportionally less weight of liquid above the bottom of the dish for the bubbles to escape through than deep ones. Rough metallic surfaces favor evaporation by boiling, and are better than smooth surfaces, because they expose a greater amount of surface to the source of heat.

Evaporation below the Boiling-Point.—In evaporating liquids *below their boiling-point*, temperature, pressure, etc., being equal, rapidity of evaporation depends upon the *extent of surface exposed to the air*. Figs. 115 and 116 show two vessels of exactly the same diameter, but of different capacity, containing water: both expose the same amount of surface to the air, but that of Fig. 116 contains eight times more liquid than that of Fig. 115.

FIG. 115. FIG. 116.



Evaporation below the boiling-point.

If both be subjected to the same temperature, *provided it be below* 100° C. (212° F.), the water will evaporate as rapidly from one as from the other.

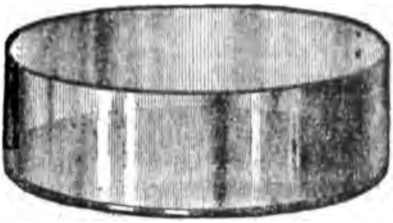
Proper Shape of Vessels for Evaporating Liquids.—Broad,

shallow vessels should be used for evaporating below the boiling-point, because the extent of surface is proportionally greater in vessels of this shape. Fig. 117 is an illustration of a porcelain evaporating dish having

FIG. 117.

Porcelain evaporating dish.

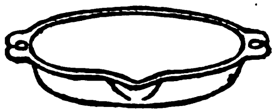
FIG. 118.



Glass evaporating dish.

the proper shape: the chief objection to dishes of this kind is their liability to breakage. Care should be taken to dry the bottom of the dish thoroughly before placing it over a gas-flame. A glass evaporating dish is shown in Fig. 118. This should always be used in a sand-bath, or should be otherwise protected from direct heat. Enamelled cast-iron dishes are very useful, notwithstanding the lack of durability of the enamel. Enamelled sheet-iron dishes, called "agate-ware," are very light, and are much more lasting than the ordinary enamelled cast-iron dishes (see Fig. 119).

FIG. 119.



"Agate-ware" evaporating dish.

Use of Stirrers.—By stirring an evaporating liquid the surface is largely increased, whilst the currents of air produced at the same time greatly assist in dissipating the vapors which rise. Upon the small

FIG. 120.

Porcelain stirrer.

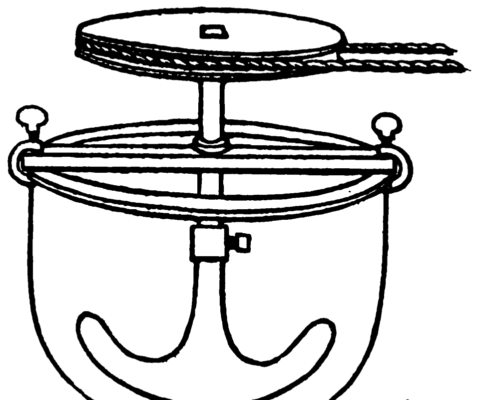
FIG. 121.

Porcelain stirrer (double).

FIG. 122.

Horn stirrer.

FIG. 123.



Rotary stirrer.

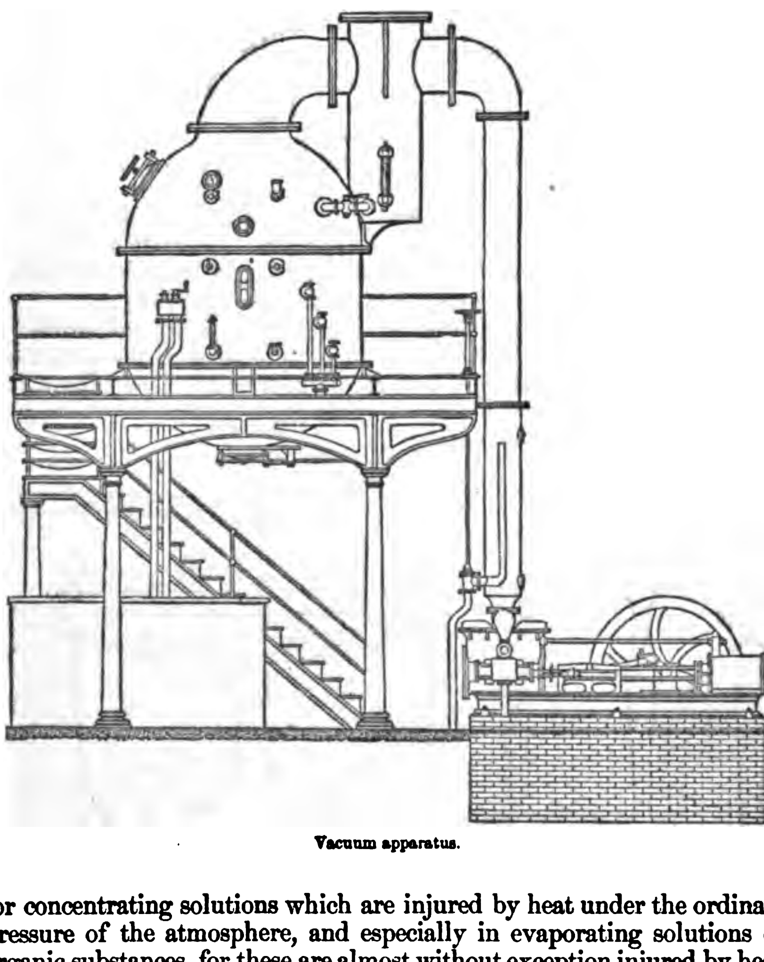
scale, porcelain, horn, or wooden stirrers are used (see Figs. 120, 121, and 122), whilst mechanical stirrers are usually employed in the labo-

ratory in more extensive operations. Fig. 123 shows a rotary stirrer to be operated by steam-power.

Vacuum Apparatus.—It has already been shown (page 130) that the boiling-point of liquids is lowered by removing the pressure of the atmosphere. This fact is easily proved by placing under the receiver of an air-pump some alcohol in a test-glass containing a few pieces of broken glass; when, upon exhausting the receiver, many bubbles of vapor will rise from the surface, and the liquid will boil at the ordinary temperature. Water will boil at 84° C. (183.2° F.) upon the top of Mont Blanc, on account of the diminished pressure of the atmosphere.

The practical application of these principles is of great importance in pharmacy, and vacuum-pans are frequently used in the larger laboratories

FIG. 124.



Vacuum apparatus.

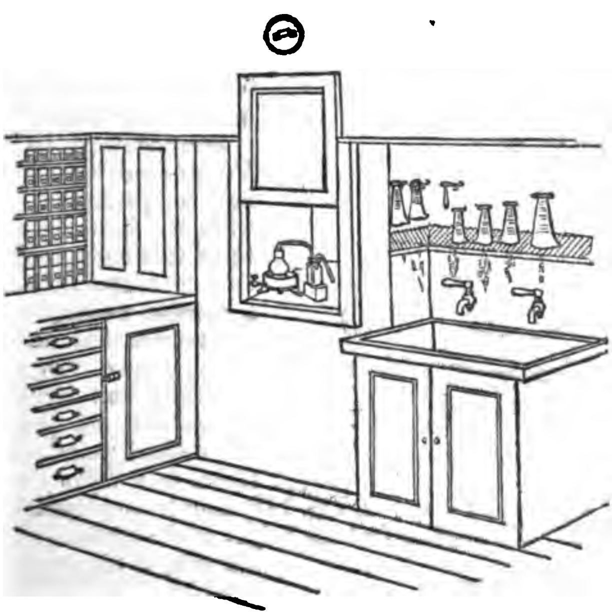
for concentrating solutions which are injured by heat under the ordinary pressure of the atmosphere, and especially in evaporating solutions of organic substances, for these are almost without exception injured by heat.

In Fig. 124 a vacuum-pan, made by Lafferty, Gloucester, N. J., is

shown. The top of the pan or kettle is furnished with a very wide pipe, which is bent twice, and connected at its lower extremity with a steam-pump. Steam-pipes are attached to the bottom of the vacuum-pan so that a moderate heat may be used if necessary. The air is exhausted from the pan upon starting the pump, and the vapor from the evaporating liquid may be condensed or wasted as desired. The pan is furnished with thermometers, gauges, windows, etc., so that the evaporation is under complete control.

It frequently happens that the pharmacist is unable to devote much space to laboratory operations; this is particularly the case in cities or large towns, where rents are high. When pharmaceutical operations must be conducted in the store, an absolutely indispensable convenience is an *evaporating chamber* (see Fig. 125). If the arrangement of the store will admit of it, this should be built into a chimney-breast. The

FIG. 125.



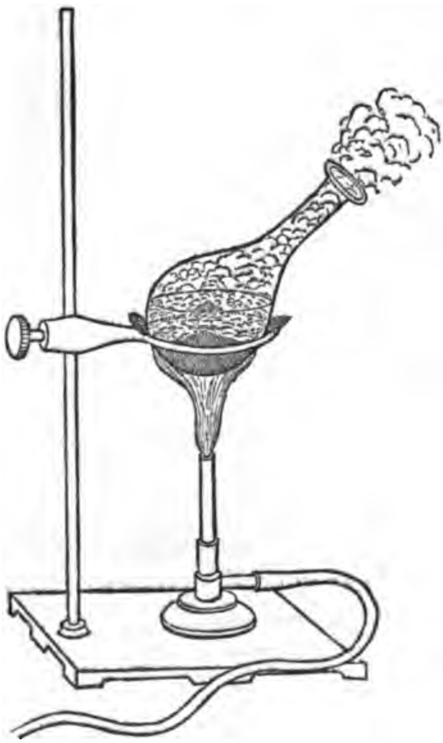
Evaporating chamber.

bottom of the chamber is preferably made of a slate slab, which should have a slight inclination towards the front, and be large enough to project about two inches over the closet upon which it rests, for the purpose of preventing a liquid, spilled by accident, from running into the closet and soiling the contents. The chamber should have a gas-pipe in it, and the upper part should connect, by a flue in which there is a damper, with a chimney having a good draught. A wooden or galvanized-iron front having a light of glass fitting tightly in it will prevent vapors or odors from getting into the store, while operations

can be seen and go on with occasional attention. The space below may be utilized as a closet for evaporating dishes, gas stoves, etc.

Evaporation by Direct Heat.—This method usually requires the greatest amount of care in order to avoid loss or injury by overheating: it is to be preferred, therefore, only in cases where the residue is not easily injured by such an accident. The evaporation of saline solutions in crystallization, or of weak aqueous organic solutions, may usually be performed by the application of direct heat. Careful watching, however, is necessary, and also frequent stirring, to prevent the formation of a crust upon the bottom. Fig. 126 shows a method of evaporating by direct heat by using a flask supported on a piece of brass-wire gauze, upon a retort stand.

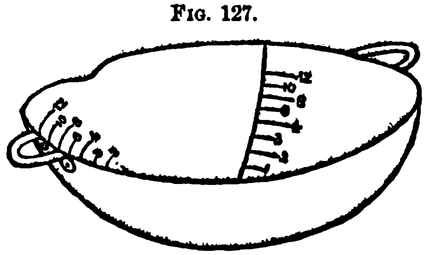
FIG. 126.



Flask evaporation.

Evaporation to a Fixed Volume.—This operation cannot be performed accurately without inconvenience, and hence it is much more satisfactory to evaporate a liquid to a definite weight,—all that is necessary in the latter case being to use a tared dish, and weigh the dish and contents when evaporation has progressed to the desired point. In evaporation to a definite measure, a graduated evaporating dish (see Fig. 127) may be employed, care being taken to level it by noticing that the height of the liquid is the same on each side, or the expedient illustrated in Fig. 128 may be resorted to. An ordinary evaporating dish, D, is placed upon a grommet, G (see page 144), and subjected to the heat (in this case the temperature is intended to be that of a warm room); a perforated wooden strip, A, is placed across the dish, and a glass thermometer, T, is supported in an upright position in the liquid by a perforated cork. Sufficient water is poured into the dish to equal the final measure of the liquid, and a small rubber band is slipped on the

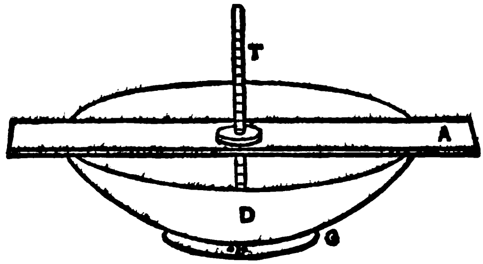
FIG. 127.



Graduated evaporating dish.

thermometer (or a piece of string tied on) to indicate the desired level of the liquid; the water is replaced by the liquid to be evaporated, and evaporation proceeded with until the liquid has been lowered to the mark on the thermometer. When the use of a thermometer is unnecessary, a notched stick may be substituted. In order to arrive at results approaching accuracy by these methods, the liquid must be allowed to cool to the temperature of the water which was used as the measure of the liquid in the beginning.

FIG. 128.



Measuring evaporation.

Use of Hoods.—A hood is a contrivance, usually of a conical shape, intended to collect and dispose of vapors which, from their disagreeable odors or their suffocating effects, render the atmosphere of the store or laboratory unwholesome. Fig. 129 shows a form of hood which has been found useful upon the small scale: it is made of galvanized iron, and connects by galvanized stove-pipe with the strong draught of a good chimney; the stove-pipe running horizontally to the chimney should have a damper in it. If any condensation of the vapors takes place in the stove-pipe, the larger diameter of the circular hood will cause the drops of liquid to fall outside of the evaporating dish, and thus contamination of the contents of the dish is avoided. Hoods are usually made of wood when intended for operations upon the large scale. Fig. 130 illustrates the method of using a hood when the dish is placed upon a stove.

FIG. 129.

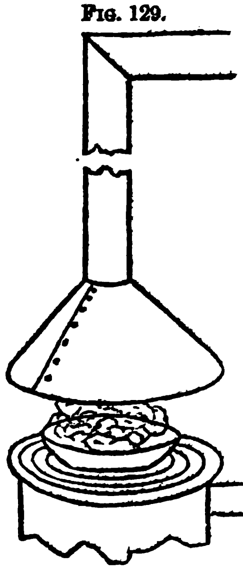
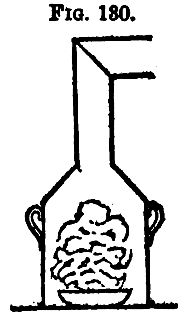

Hood.

FIG. 130.

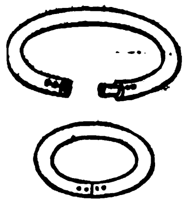

Stove hood.

Use of Grommets.—One of the inconveniences in using round-bottomed evaporating dishes is due to the shape of the bottom, serious loss often occurring from the tilting of the dish and spilling of the contents: to obviate this, *grommets* should be used. These may be economically made from a cast-off piece of rubber hose or tubing by bending it into a circle, placing a wooden plug in one end, tacking it securely, and inserting it in the other end and fastening it in the same manner (see Fig. 131): an elastic ring is thus formed, upon which an evaporating dish or round-bottomed vessel may be safely placed. Grommets serve another very important purpose, that of preventing the fracture of a porcelain or

glass dish containing a hot liquid, by being placed between the hot dish and the cold surface of a table or floor.

Spontaneous Evaporation.—By this term is meant the evaporation of a liquid at the ordinary temperature of the atmosphere, or without the application of strong, direct heat. It is used in cases where the residue or less volatile liquid is liable to injury or loss by the application of much heat, or in crystallization, where, by the slow vaporization of the volatile liquid, finely-formed crystals may be secured, and in other less important operations. Spontaneous evaporation is usually conducted in drying-rooms or closets when they are accessible; these, as will be subsequently described, are rooms or closets which are very slightly heated by the use of exhaust steam or other means; or this form of evaporation may be used by placing the liquid in shallow dishes or trays and exposing the surface to the rays of the sun during fine weather. Upon the small scale, one of the most convenient methods is to support the dish upon a wire tripod placed upon a stove, at a sufficient distance above the top of the stove to avoid injury, or if heated air from a furnace is available, it can be utilized by supporting the dish, properly protected, over the register; the upward current of dry heated air greatly assists in promoting the evaporation.

FIG. 181.



Grommets.

Table of Boiling-Points of Official Substances.

Æther	37° C.	=	98.6° F.
Carbonei Disulphidum	46°–47° C.	=	114.8°–116.6° F.
Benzinum	50°–60° C.	=	122°–140° F.
Chloroformum	60°–61° C.	=	140°–141 8° F.
Spiritus Ætheris Nitrosi	65° C.	=	149° F.
Æther Aceticus	76° C.	=	168.8° F.
Alcohol	78° C.	=	172.4° F.
Amyl Nitris	96°–99° C.	=	204.8°–210.2° F.
Aqua	100° C.	=	212° F.
Acidum Aceticum Glaciale	117°–118° C.	=	242.6°–244.4° F.
Acidum Nitricum	120.5° C.	=	248.9° F.
Paraldehydum	123°–125° C.	=	253.4°–257° F.
Oleum Sinapis Volatile	148°–150° C.	=	298.4°–302° F.
Oleum Terebinthinæ	155°–170° C.	=	311°–338° F.
Terebenum	156°–160° C.	=	312.8°–320° F.
Oleum Terebinthinæ Rectificatum	160° C.	=	320° F.
Glycerinum	165° C.	=	329° F.
Eucalyptol	176°–177° C.	=	348.8°–350.6° F.
Oleum Amygdalæ Amaræ	180° C.	=	356° F.
Acidum Carbolicum	188° C.	=	370.4° F.
Camphora	204° C.	=	399.2° F.
Creosotum	205° C.	=	402.8° F.
Menthol	212° C.	=	413.6° F.
Naphtalinum	218° C.	=	424.4° F.
Oleum Gaultheriæ	218°–221° C.	=	424.4°–429.8° F.
Oleum Betulæ Volatile	219°–221° C.	=	426.2°–429.8° F.
Methyl Salicylas	219°–221° C.	=	426.2°–429.8° F.
Camphora Monobromata	274° C.	=	525.2° F.
Naphtol	286° C.	=	546.8° F.
Acidum Sulphuricum	338° C.	=	640.4° F.
Hydrargyrum	357.25° C.	=	675.05° F.

QUESTIONS ON CHAPTER IV.

VAPORIZATION.

What is vaporization?
What is evaporation?
What is distillation?
What is desiccation?
What is exsiccation?
What is granulation?
What is sublimation?
What is meant by ebullition or boiling?
What is meant by the boiling-point of a liquid?
Is the boiling-point of a liquid a definite temperature?
Is the evaporating-point of a liquid a definite temperature?
What is the boiling-point of water under the ordinary pressure of the atmosphere?
When confined under pressure, how high can its temperature be raised without boiling?
What will be the effect upon boiling if the pressure is made much less than that of the atmosphere?
How may the boiling-point of a liquid be determined accurately?
What is meant by the tension of vapors?
What effect have cold and pressure upon vapors?
What effect have heat and removal of pressure upon vapors?
Upon what does the quantity of vapor that will form in a confined space depend?
How is the evaporation of a liquid influenced by the pressure or absence of aqueous vapor in the air?
How may the rapidity of evaporation be increased?
Why does increase of temperature hasten evaporation?
In evaporation by boiling, temperature, pressure, etc., being equal, upon what does the rapidity of the process depend?
When a pure volatile liquid is evaporated by boiling in the open air, does the temperature change with the amount evaporated?
If there is solid matter dissolved in the liquid, what takes place on evaporation?
What inference should be drawn from this,—for example, in the preparation of extracts?
Which are most easily evaporated,—thin, mobile liquids or dense and thick ones, and why?
Does the depth of a liquid influence its boiling-point?
Why are rough metallic surfaces better for evaporation than smooth ones?
In evaporating liquids below the boiling-point, temperature, pressure, etc., being equal, upon what does the rapidity of the process depend?
Therefore, what shaped vessels should be used for evaporating liquids below the boiling-point?
What effect is produced by stirring an evaporating liquid?
Will water boil at a higher or lower temperature in more elevated positions, and why?
What application is made of this principle in pharmacy?
What is an evaporating chamber, and how should it be constructed?
What is the objection to evaporating liquids by direct heat?
In evaporating a liquid to a definite measure, how may it be ascertained when the measure has been reached?
What is a hood, and what is its use?
What is a grommet, and what are its uses?
What is meant by spontaneous evaporation?
How may it be advantageously conducted?

CHAPTER V.

DISTILLATION.

THE first part of the process of *distillation* is identical with that of evaporation, for it is simply the *vaporization* of the volatile liquid through the application of heat. The next step is distinctive and opposite, and consists in the conversion of this vapor into a liquid by the application of cold: this part of the process is called *condensation*.

The elements of distillation are: 1, vaporization, and, 2, condensation. The subject of vaporization was treated of in the preceding chapter: we have now to consider condensation.

Condensation.—It has been already shown (page 128) that when a *liquid* is *vaporized* a certain amount of heat disappears or is rendered latent, and when a *vapor* is *liquefied* a corresponding degree of heat is evolved or reappears. Whilst the practical application of this law is of great service in the use of steam for heating purposes, the opposite process of condensation shows its disadvantages, because of the relatively large quantity of cold water necessary to liquefy vapors.

The greater the difference in temperature between the condensing surface and the vapor, the more rapid is the condensation; and it has been computed that steam at 100° C. (212° F.) requires about twenty-five times its weight of water at 20° C. (68° F.) to condense it. The proper relation between the heating and condensing surfaces of apparatus used in distillation can only be known by careful study of the laws governing vaporization and condensation, or by practical experience.

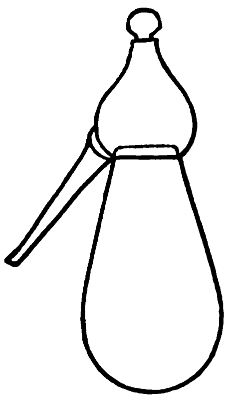
Apparatus used in Distillation.—In considering the many kinds of apparatus used in distillation, two typical forms are presented: 1, the *alembic form*, in which the vapor is condensed in an enclosed space immediately above the heated liquid, and, 2, the *retort* form, in which the vapor is condensed in a vessel placed at one side of that containing the heated liquid, and connected with it by a suitable tube or pipe.

The Alembic.—This is probably the most ancient kind of distillatory apparatus, and in its original form it is now rarely employed. The *body*, or *cucurbit*, is usually globular or oval in shape, and at its junction with the hemispherical *head* or *dome* there is a gutter or groove. This serves to collect the condensed vapor or distillate, which is carried off by a tube, as shown in the illustration (see Fig. 134).

Fig. 135 shows an alembic which, according to Mr. Brady, of Newcastle, England, is still frequently employed in Japan. Into the boiler, *a*, is fitted a short cylinder, *b*: this has a perforated bottom, and the gutter communicates with the spout; the condenser, *c*, has a cover, *d*,

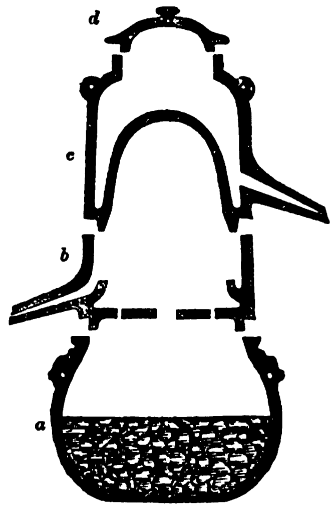
and is also furnished with a spout for carrying off the water used in cooling the dome after it has been heated by the vapors rising from the boiling liquid in the body. This still, or, as it is called by the Japanese, *lambik*, is shown because it represents the alembic probably in one of its

FIG. 184.



Alembic.

FIG. 185.

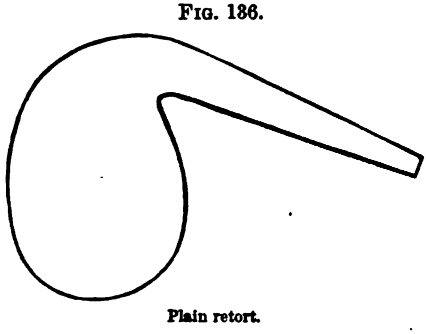


Japanese lambik.

best practical forms, and the advantages possessed by this kind of distilling apparatus are seen to be compactness and simplicity. It is, however, not fitted for distilling very volatile liquids, is very inconvenient and troublesome, because of the necessity for constantly replacing the water used in the condenser, and distillation is slow and tedious.

The Retort.—This form of distillatory apparatus has many advantages over the alembic, which it has almost entirely replaced. A retort, in its simplest form, may be described as a long-necked glass flask in which the neck, after being heated thoroughly, is bent over until its axis makes an acute angle with that of the bowl of the flask. Retorts are of two kinds,—plain and tubulated. A *plain* retort has just been described (see Fig. 136). If it has a *tubulure* or orifice at the top of the bowl for the purpose of introducing the liquid to be distilled, it is said to be *tubulated* (see Fig. 137). Retorts are made of glass, porcelain, earthenware, platinum, iron, lead, etc., according to the purposes for which they are designed.

FIG. 136.



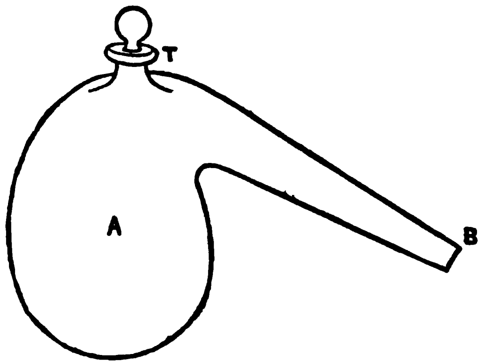
Plain retort.

Porcelain and earthen-ware retorts are used in the distillation of

phosphorus, mercury, etc.; platinum and iron retorts, in destructive distillation; leaden retorts, in making hydrofluoric acid, ether, etc.

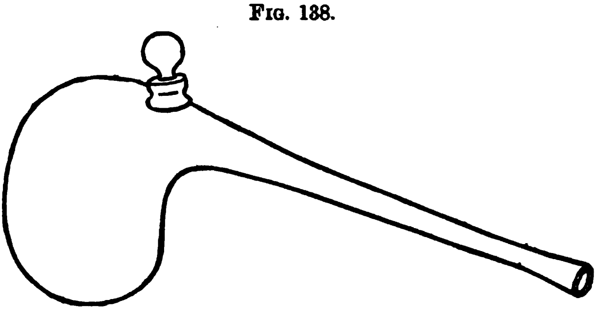
The glass retort is the only kind, however, which will be considered here in detail. The shape of a retort is an important point to regard in its selection: retorts having deep bowls are best suited for very volatile liquids. The lower surface of the neck of the retort should form a decidedly acute angle with the surface of the bowl if tubulated; a line drawn from the centre of the stopper should touch the centre of the bowl, A, so that when a funnel is introduced into the tubulure, T, to charge the retort, the contents may all be delivered into the bowl without soiling or splashing the neck. The neck of the retort should gradually taper to the end, and the beak, B, should never be larger in diameter than any other portion of the neck, otherwise difficulty may be experienced in making joints with adapters, receivers, or condensers (see Fig. 138). Such a fault may prevent the use of a cork ring in joining, for this ring should be made tight by forcing it up the gradually-increasing diameter of the neck. The glass forming the retort should be carefully annealed and have a uniform thickness: extremes should be carefully guarded against. If the glass be too thick, the sudden changes in temperature, to which retorts are constantly subjected in distillation, may cause fracture; on the other hand, if too thin, they are easily broken in cleaning. Scratches and imperfections in the bowl should cause retorts to be rejected.[1] The objections to the use of retorts are mainly due to

FIG. 187.



Tubulated retort.

FIG. 188.

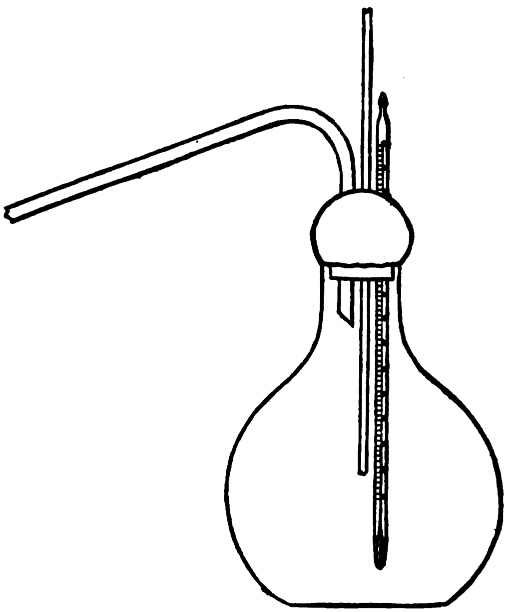


Badly-formed retort.

[1] Although there is no disposition on the part of the author to weaken the force of this conventional advice, the possession of a retort having a large bubble in the bottom of the bowl, which has been in successful use for ten years and has outlasted many of its more perfect fellows, supplies the needed exception.

their peculiar shape, the principal one being the difficulty of cleaning them thoroughly. The necessity for having a variety of different shapes and sizes to suit special operations is greater than when distillation is performed with flasks and bent tubes.

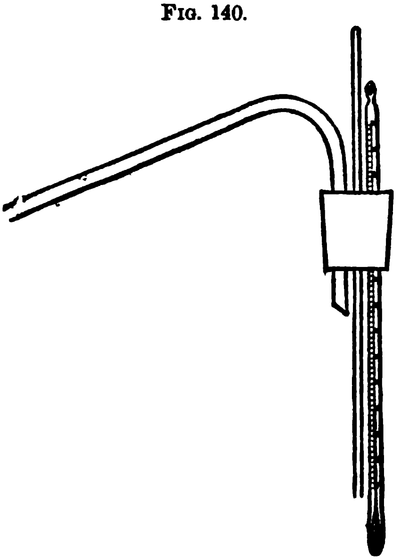
FIG. 139.



Distilling flask.

Flask distillation will be usually found most practicable for pharmaceutical work. The best shape for a flask is shown in Fig. 139. The bowl should have a flat bottom, so that it will stand unsupported; the neck should be wide, to admit a large cork, so that there will be plenty of room for a wide bent tube, a thermometer, and a safety or charging tube (see Fig. 140). The advantages of using a flask instead of a retort for all distillations that will allow of it are several: it is easily cleaned, it is useful for other purposes, for instance as a measure, as a container, or as a receiver for the distillate, and the parts are readily replaced in case of breakage. One of the most important parts of this apparatus is the bent tube for conducting the vapor to the receiver or condenser: the diameter of the tube should be as large as the receiver or condenser will conveniently accommodate.

FIG. 140.



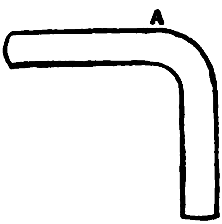
Bent tube, etc., for distilling flask.

Cutting Glass Tubes.—The glass should be moderately thick and of the proper length. A glass tube may be broken neatly by scratching it across with a sharp three-cornered file, and then grasping it with both hands, one on each side of the scratch, and making a slight outward pressure, which will generally produce a clean fracture: by holding the sharp edges for a few moments in the flame the corners

may be rounded so that they will pass through a cork without cutting it and making a ragged edge.

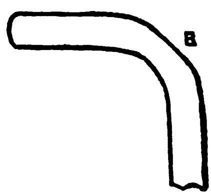
Bending Glass Tubes.—A tube may be bent by heating it properly over a gas-flame. To make a symmetrical curve in a tube of large diameter requires considerable skill and practice. One end of the tube should be closed by a cork, and the part of the tube that is to be bent held just above the flame and gradually rotated between the fingers, so that it may be heated evenly throughout: it should also be passed to the right and left through the flame for the space of an inch or two on each side of the middle of the proposed bend, and very slowly allowed to curve in one direction, so that the bend shall not be too abrupt. The object of closing one end with a cork is to prevent a current of air from passing through, and, in case collapse from overheating occurs, by gently blowing in the tube the softened glass may be swelled to its proper curve. Fig. 141 shows a tube properly bent, while Figs. 142 and 143 illustrate some of the defects produced by unskilled work. In Fig. 142 the tube was not rotated evenly, and at the top of the bend,

FIG. 141.



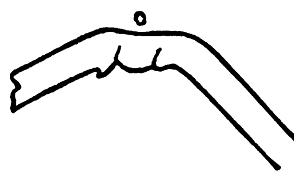
Tube properly bent.

FIG. 142.



Tube unequally heated.

FIG. 143.



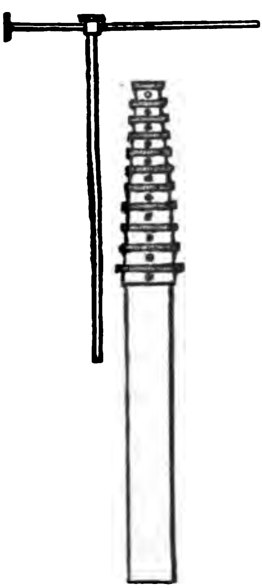
Tube hastily bent.

B, it was hot enough to collapse. Fig. 143 represents the effects of hurry and unequal heating, the operator having forced the bend, C, before the tube was heated uniformly. A gas-burner having a solid, steady flame is the best kind to use (see Fig. 66), and draughts of air should be avoided.

Cork-Fitting.—Corks for joining apparatus should be of *the best quality*. They are perforated for the passage of the glass tubes by the use of cork-borers (see Fig. 144). These are cylindrical brass tubes of various sizes, sharpened at one end, and surmounted by a milled-brass cap: they are furnished in sets. A small hole is drilled through both sides of the brass cap, so that an iron rod may pass directly through it and form a convenient handle. They are used by holding the cork firmly with the left hand and pushing the borer through with the right hand, using a twisting motion at the same time so as to cut a smooth round hole. The mistake frequently made in using cork-borers is due to "hurry:" the attempt to force the borer through quickly without rotating it sufficiently, always ends in breaking off pieces of the cork. The cork-borer shown in Fig. 145 is much more convenient for larger corks, and should be used where cork-borers are often needed, the tool-handle, I, being large enough to give the operator a firm grasp, so that the cork may be readily bored. The cutting edge of the borers should always be kept sharp and in good condition by the use of the grindstone

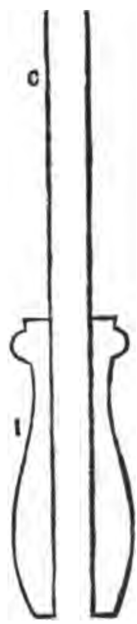
or emery-paper. When the cutters do not bore a hole of the exact size needed for the glass tube, which of course should fit tightly, it is best to select a borer which will cut a smaller hole than that desired, and then to enlarge the hole by filing with a rat-tail or half-round file (see Fig. 146). When the tubes have been fitted, the cork should usually be thoroughly soaked in hot water, for the purpose of swelling and softening it: it should never be soaked before cutting or filing. The rasp and file shown in Fig. 147 will be useful in fitting up large flasks. Rubber corks can often be used with great advantage, and they may be readily perforated by dipping the cork-borer in solution of caustic soda or potassa or strong water of ammonia before beginning to use it. If rubber corks are well dried by wiping them thoroughly, they may be filed easily with a new, sharp, flat file. The main advantage of rubber corks is that they are practically impervious to vapors or gases, and hence require no luting. Substitutes for rubber corks may be made by keeping dry corks in melted paraffine or wax until the pores are thoroughly filled, and then cooling.

FIG. 144.



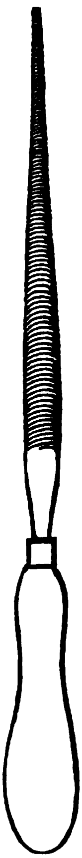
Cork-borers.

FIG. 145.



Cork-borer (large size).

FIG. 146.



Rat-tail file.

FIG. 147.

Rasp and file.

Lutes.—The most satisfactory lute for ordinary distillations is made by adding flaxseed-meal to *boiling water* and stirring until a thick, sticky mass results. When the perforated and soaked cork containing the tubes is inserted in the neck of the flask, a small quantity of lute

should be pressed into the joints, and then followed by sufficient to make the joint vapor-tight, the quantity varying with the quality of the cork and the character of the vapor that is to be excluded. If future trouble from leaking is to be avoided, it is usually better to throw away a cork which will not make an almost perfect joint without lute, rather than trust to cover up serious deficiencies with lute. A neat finish may be given to the joint by dipping a finger into water, and with it smoothing the surface of the lute. In Fig. 140 the cork is shown perforated and mounted; in Fig. 139 it is luted and in position.

Bladder Joints.—One of the most useful substances to the practical pharmacist who has occasion to join tubes is a strip of moistened bladder. Hogs' bladders are usually preferred, and it is now possible to get them of excellent quality prepared by being thoroughly cleaned and then soaked in an alkaline solution or in benzin to deprive them entirely of fat. In connecting two tubes of different diameters which are not to be subjected to a high heat, a bladder joint is especially useful. For an ordinary joint of inch glass tube, a strip about six inches long and an inch and a half wide should be moistened and wrapped around the proposed joint; the upper end of the bladder is then tied tightly with strong linen twine, leaving the short end of the twine at least six inches long; this end is carried along the top of the bladder and tied tightly around the lower end of the joint; the long end of the twine is then wrapped spirally and regularly around the bladder until the lower end is reached, when it should be there tied tightly (see Fig. 148). Strips of writing-paper soaked for a few moments in water, and then coated with ordinary, smooth flour-paste to which ten per cent. of glycerin has been added, may also be used for joining apparatus.

Fig. 148.

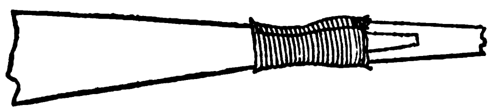
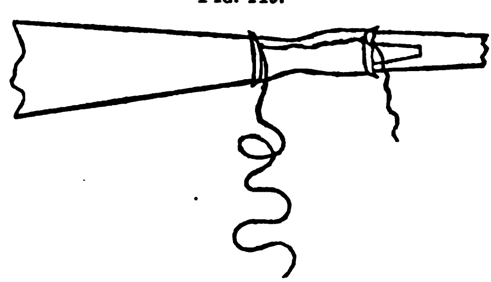


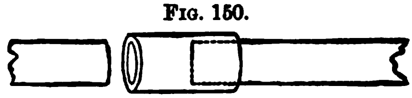
Fig. 149.



Bladder joints.

Rubber joints are preferred to bladder joints when there is no likelihood of vapor or high heat dissolving or softening the rubber, and when the tubes to be joined are nearly of the same diameter: the ease and celerity with which such joints can be made are their strong points. A piece of rubber tubing is cut of slightly less diameter than that of the tubes to be joined; by moistening the rubber on the inside with water, and stretching it over one end of the glass tube, and then inserting the end of the other glass tube, the joint is made. Success largely depends upon having the rubber tube slightly smaller in diam-

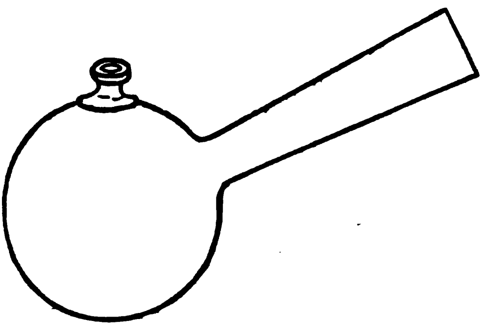
Fig. 150.



Rubber-tube joint.

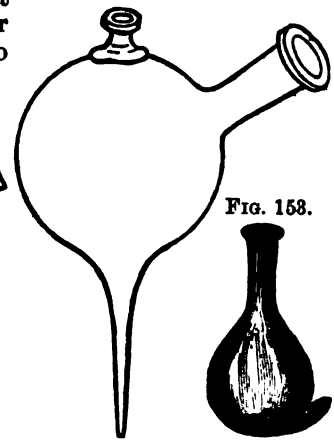
eter than the glass tube, so that the elasticity of the rubber alone will be sufficient to make a tight joint, otherwise the rubber tube must be tied on, and then the advantage over a bladder joint is lost (see Fig. 150). In all cases it is preferable to select tubes which differ slightly in diameter, so that one may slip into the other, the narrower of course having the higher position, so that the vapor or liquid shall not come in direct contact with the rubber.

FIG. 151.



Tubulated receiver.

FIG. 152.



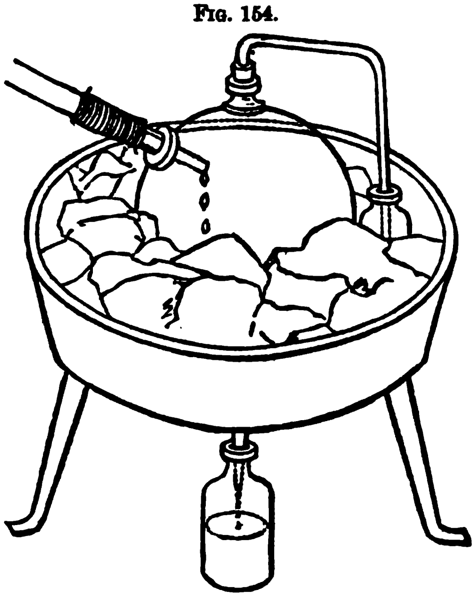
Tubulated and quilled receiver.

FIG. 153.

Plain receiver.

Receivers are glass vessels, usually globular in shape, intended to receive distillates. They are of three kinds,—*plain*, *tubulated*, and *quilled* (see Figs. 151 and 152). When a plain receiver is required, an ordinary flask (see Fig. 153) will answer, but if uncondensable vapors are produced, it is necessary to provide for their escape, or an explosion may occur from the accumulated pressure: this may be done in a tubulated receiver by occasionally removing the stopper, or, better, by connecting a bent glass tube with the receiver and allowing the end of the tube to dip into water, or into an acid solution if the vapors be alkaline, or into an alkaline solution if the vapors be acid. A quilled receiver is useful where the distillation is to be carried to a definite point and a certain amount of distillate is to be received, or, as in the prepara-

FIG. 154.

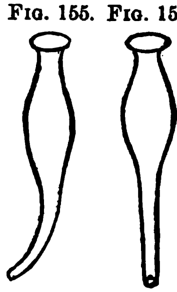


Mode of using quilled receiver.

tion of hydrocyanic acid, the end of the quill is made to dip below the surface of the cooled diluted alcohol or water, in order to condense all of the gas. In the distillation of very volatile liquids an effective mode of using a quilled receiver is shown in Fig. 154. A hole is cut in the bottom of a rather shallow tin pan and a short tube soldered into it; a perforated cork will permit the quill of the receiver to pass through it, and at the same time a tight joint should be made; ice or snow is heaped up over the receiver, and any uncondensible gases may escape from the bent tube in the tubulure or be absorbed by the liquid into which the tube dips.

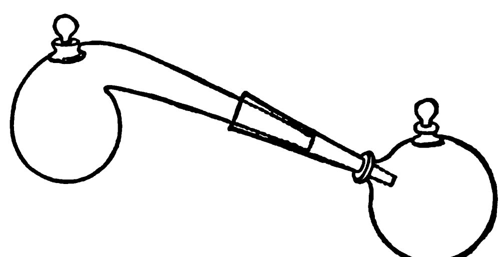
Adapters are tapering tubes of glass which are used to connect retorts with receivers. Fig. 155 shows the bulbed and bent form. Good adapters may be made from retorts having broken bulbs by cutting off

Fig. 155. Fig. 156.



Adapters.

Fig. 157.



Use of adapter.

the broken portion, scratching the tube with a file, and extending the crack thus made entirely around it by slowly passing a red-hot poker over the line marked for the fracture. Fig. 157 shows an adapter of this kind in position.

Charging Retorts.—Plain retorts must be charged by using a funnel-tube: this may be a funnel with an elongated tube, or a modification of it, as shown in Figs. 158, 159, and 160, or one may be improvised by selecting a tube of sufficient diameter to permit of the introduction of a small funnel (see Fig. 161). The object of using a funnel-tube is to prevent the soiling of the neck of the retort; as the object of distillation is usually to purify the liquid, the latter must be delivered into the bowl of the retort without touching the neck. Fig. 162 shows the method of charging a plain retort; a small piece of rubber tube, R, is sometimes placed on the end of the funnel-tube to guide the liquid safely. Tubulated retorts are charged by simply placing a funnel in the tubulure and pouring the liquid in.

Fig. 158.

Stoppered funnel-tube.

Fig. 159.

Funnel-tube.

Fig. 160.

Thistle-top funnel-tube.

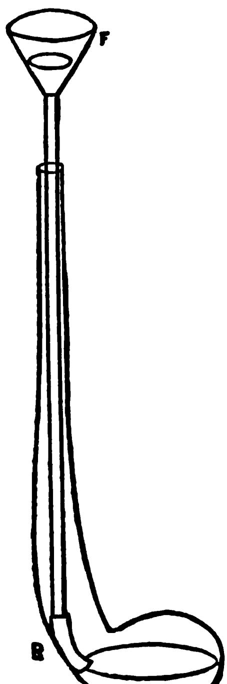
Safety-Tubes.—It is sometimes impossible to avoid sudden evolu-

tions of vapor during distillations. When there is a likelihood of such occurring, it is advisable to insert a Welter's safety-tube into the tubulure of the retort. This tube (see Fig. 163) is bent into the form of an S, having a bulb blown in the middle, and a thistle funnel at the top. Mercury is poured into the tube before inserting it into the tubulure of the retort, and a piece of loose cotton is placed in the thistle funnel; when undue pressure occurs, the mercury is forced into the cotton and the vapor escapes; when the retort has been thus relieved, the mercury descends into the bulb and the distillation proceeds.

FIG. 161.

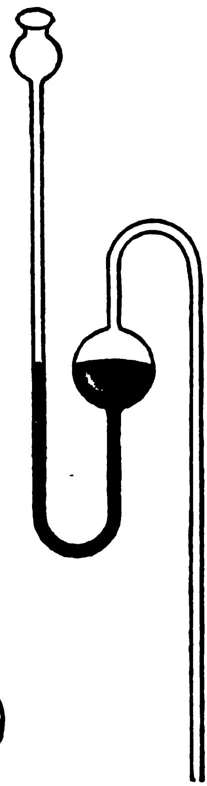
Improvised funnel-tube.

FIG. 162.



Charging a plain retort.

FIG. 163.

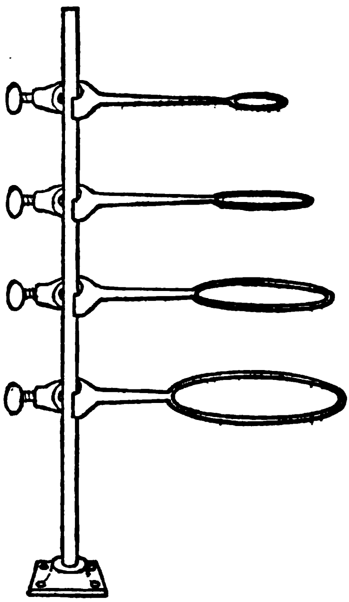


Welter's safety-tube.

Retort-stands are used to support properly retorts, flasks, receivers, etc., during distillation, although they are also employed by pharmacists for a variety of other purposes, as in filtration, percolation, evaporation, etc. Fig. 164 shows a retort-stand which has been used with much satisfaction in the laboratory of the Philadelphia College of Pharmacy. It is more substantial than those that are commonly furnished by the chemical-apparatus makers. The clamp (see Fig. 165) is made upon the principle of one originally devised by S. Lloyd Wiegand, and is hook-shaped, so that any of the different sizes of rings may be unscrewed from the upright rod without disturbing the rest. In many of the common retort-stands the bottom ring cannot be removed without first slipping off all above it. Fig. 166 shows the ordinary retort-ring. The almost universal fault of the retort-stands in common use is their extreme lightness and want of stability; the rings frequently bend under such weights as should be easily borne, and, owing to the base being too light and small, the whole stand is sometimes upset during an operation. In the stand shown in Fig. 164 the base-plate is permanently fastened to the operating counter in a place known to be the most convenient; if the counter is one that must be used for other purposes, the base-plate may be screwed to the under side of the counter, and a five-eighths-inch

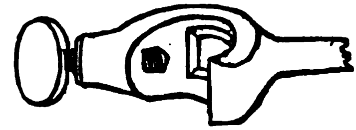
hole bored through the counter, so that the centre shall coincide with the centre of the hole in the base-plate. When the retort-stand is not in use, the hole in the counter may be closed with a cork. The upright is made of half-inch iron tubing, and can be quickly screwed into the base-plate

FIG. 164.



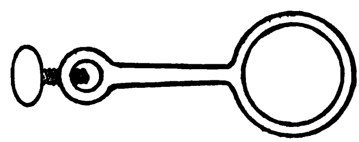
Retort-stand.

FIG. 165.



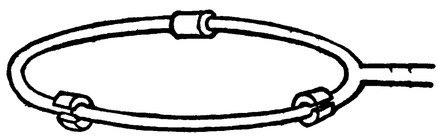
Retort-ring clamp.

FIG. 166.



Retort-ring.

FIG. 167.



Ring with split sections of rubber tubing.

with the hands without the use of pipe-tongs. The rings and clamps are in one piece, and are made of malleable iron, so that if dropped on the floor they are not likely to break. When used for holding a glass percolator or funnel, the danger of fracture on account of the contraction of the iron ring may be avoided by stretching three split sections of rubber tubing upon it (see Fig. 167).

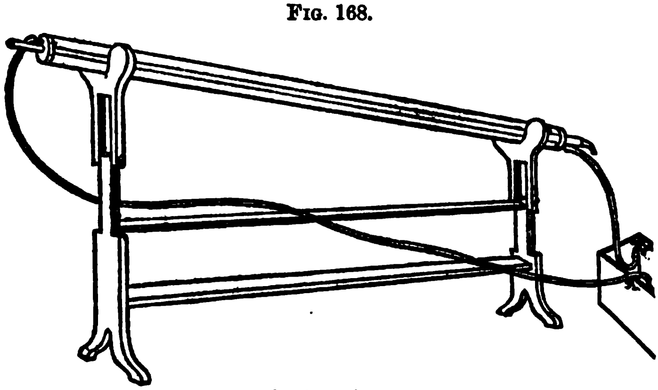
Bumping is the term applied to a phenomenon occurring when certain liquids are heated to the boiling-point in glass vessels. Ebullition often proceeds regularly at first and the vapor is given off continuously, when suddenly the surface of the liquid will become smooth for a few seconds. This is succeeded by a slight explosion, when the accumulated vapor is violently expelled and the liquid is said to "bump:" these effects occur alternately, and increase as distillation progresses, and some liquids, particularly sulphuric acid, cannot be distilled in glass vessels without using certain precautions. The exact cause of bumping has not yet been satisfactorily explained, but the fact that the forces of cohesion and adhesion in certain liquids are greater when they are boiled in glass vessels than in metallic vessels has been proved. The expedients that have been used to prevent bumping, or rather to lessen its effects, usually consist in the addition of some insoluble solid substance to the liquid, such as broken glass, a fragment of charcoal (when admissible), piece of clay pipe, rock crystal, etc.; these serve to break

the explosive force of the vapor in its upward course, and are thus serviceable. Probably as good an expedient to use as any in pharmaceutical operations, is to add a few pieces of glass of irregular shape to the liquid before it is heated.

LIEBIG'S CONDENSER.

This condenser, although now bearing the name of the great chemist, was used before his time. It consists of a long glass tube, surrounded by another tube of larger diameter; two small openings are made, one near the bottom and the other near the top of the large tube. Connection is made with the tube leading to the bottom with a cold-water supply, and the water circulates in the space between the inside of the large tube and the outside of the smaller tube, and finally has its exit at the opening near the top. Fig. 168 shows a large condenser of this

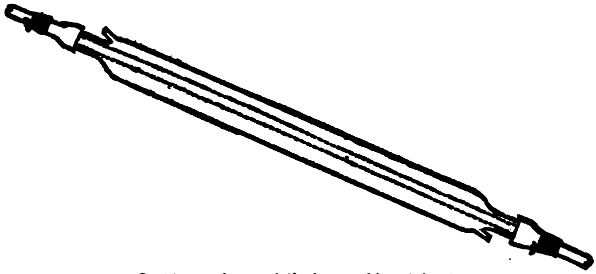
FIG. 168.



Liebig condenser.

form, well suited for illustrating the process of condensation practically. Both tubes are of glass, the ends being of rubber, and made by cutting

FIG. 169.

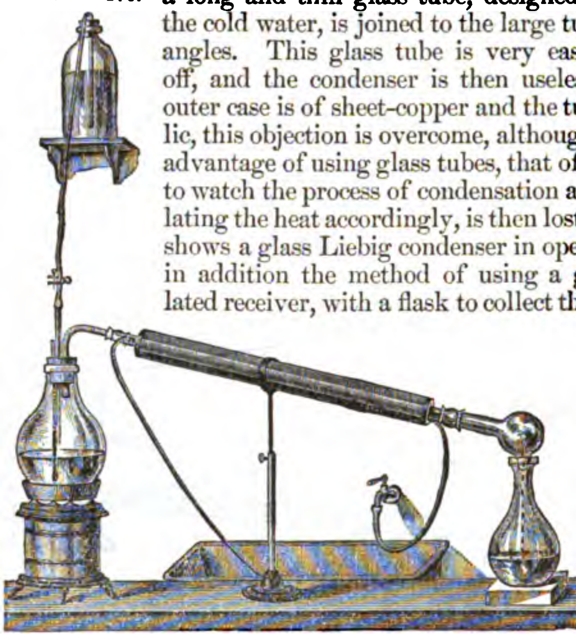


Liebig condenser (all glass, rubber joints).

two sections from a clothes-wringer roller; the lowest rubber cork is perforated at its lowest convenient point, for the introduction of a short piece of glass tubing, and the upper rubber cork is similarly perforated for the same reason. A rubber tube connects the lower short glass tube with the cold-water supply, whilst another rubber tube, connected with

the upper short tube, carries off the warmed water. For smaller condensers the form shown in Fig. 169 answers very well; the outer glass tube is contracted at the ends and supplied with short tubes as shown, a rubber tube or bladder joint being used to make the joint between the condenser tube and the outer tube. This form is recommended in preference to the kind frequently sold, in which a long and thin glass tube, designed to supply the cold water, is joined to the large tube at right angles. This glass tube is very easily broken off, and the condenser is then useless. If the outer case is of sheet-copper and the tubes metallic, this objection is overcome, although the great advantage of using glass tubes, that of being able to watch the process of condensation and of regulating the heat accordingly, is then lost. Fig. 170 shows a glass Liebig condenser in operation, and in addition the method of using a glass tubulated receiver, with a flask to collect the distillate.

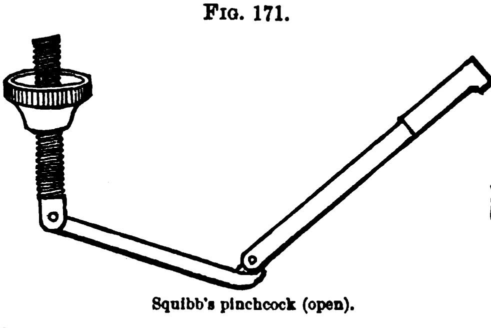
FIG. 170.



Liebig condenser (in use).

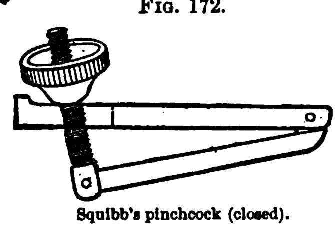
The liquid which is being distilled is gradually supplied to the distilling flask by the feed-tube from the contents of the bottle on the shelf; the rate of flow is controlled by a pinchcock compressing the rubber tube. An enlarged view of the best form of pinchcock to use for this purpose is shown in Figs. 171 and 172. It was contrived by Dr. Squibb to overcome the annoyances experienced in using the ordinary forms. It can

FIG. 171.



Squibb's pinchcock (open).

FIG. 172.

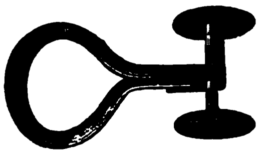


Squibb's pinchcock (closed).

be easily and quickly applied to or removed from a rubber tube without breaking a joint, and much more perfect control of the flow can be

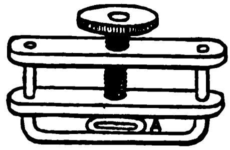
secured than by the form seen in Fig. 173, which is known as Mohr's. Hoffman's screw pinchcock (see Fig. 174) is often useful, but it cannot be applied or removed so conveniently as Squibb's. A section of compressed tube is shown at A. Fig. 175 shows a method of refrigeration which may be used when the ordinary condensers and a steady supply of water are not to be had. A wide tube is connected with the distilling flask, and some lint, lamp-wick, or other absorbent material is wrapped spirally around it and tied at the ends; a square piece of cardboard is perforated so that it will fit tightly upon the tube, and it is pushed upon the lower end until it is in close contact with the lint; if water can be supplied from a faucet, a rubber tube is connected with it and conducted to the upper part of the condensing tube, and tied in such a position that a stream of water will trickle from it and be carried down by the lint until it reaches the cardboard, where it falls into the vessel prepared to receive it. If hydrant water is not available, a large bottle containing water may be placed upon a shelf, and a syphon, having a rubber tube and pinchcock, attached, as shown in the cut.

FIG. 173.



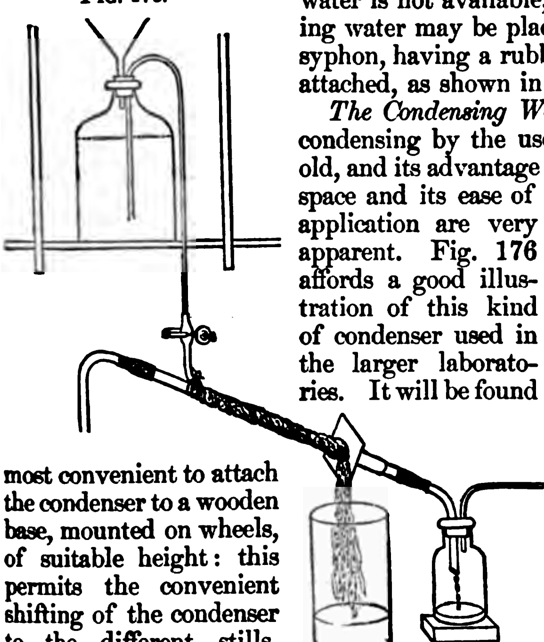
Spring pinchcock (Mohr's).

FIG. 174.



Screw pinchcock (Hoffman's).

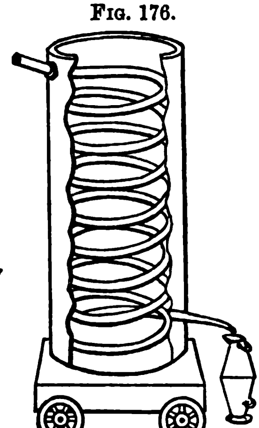
FIG. 175.



Tube condenser.

The Condensing Worm.—The method of condensing by the use of the worm is very old, and its advantage in securing economy of space and its ease of application are very apparent. Fig. 176 affords a good illustration of this kind of condenser used in the larger laboratories. It will be found most convenient to attach the condenser to a wooden base, mounted on wheels, of suitable height: this permits the convenient shifting of the condenser to the different stills. Block-tin pipe is the best that can be used for general pharmaceutical work. Copper or tinned-copper tube should be avoided, because it is impossible to prevent the action of acid vapors or liquids upon the copper; soluble salts of copper would thus be

FIG. 176.



Condensing worm.

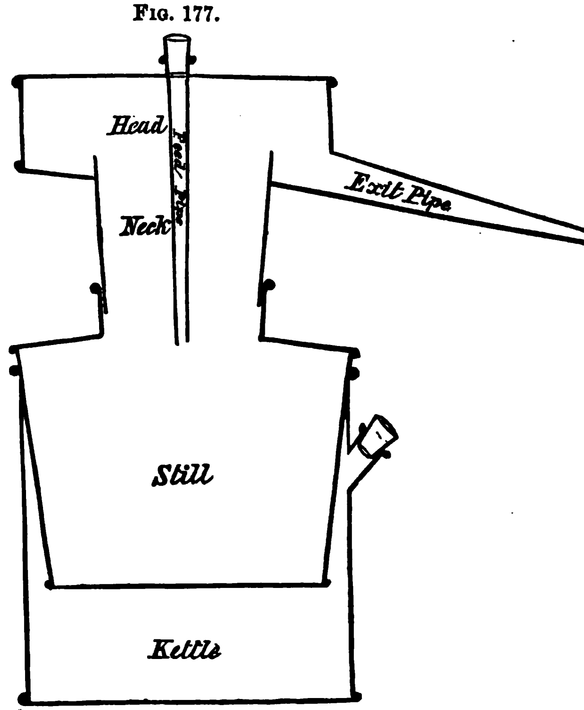
formed and the distillate often rendered poisonous. Iron tube is not admissible, on account of the contamination from iron salts; pure tin is not affected so easily, and the salts that possibly would be formed are not so objectionable. Block-tin pipe may be wound spirally around a convenient cylindrical vessel, such as a tin can or similar object, to give it the proper shape, and then fastened to three notched uprights and placed in position, as shown in Fig. 176. Earthen-ware condensing worms of all sizes, of excellent quality, are made by Doulton & Watts, Lambeth, London, England, and by John Cliff & Sons, Leeds, England. For condensing acid vapors, as in making spirit of nitrous ether, these condensers are undoubtedly superior to metallic ones.

PHARMACEUTICAL STILLS.

Stills are preferred in all distillatory operations where the liquids or vapors do not act chemically upon the metals of which they are made. Tinned copper is the best material to use in the construction of stills, for, although tinned iron is cheaper, the greater durability of the former renders them in the end more economical. The same typical forms may be seen in the construction of pharmaceutical stills as in glass distillatory apparatus,—*i.e.*, the alembic and retort.

Pharmaceutical Stills—Alembic Principle.—One of the most useful stills constructed on this principle was devised by Prof. Procter in 1847. The still body was connected with the condensing head or dome by a water-joint, and the sides of the dome were continued up into the head so that an alembic-gutter was formed to catch the condensed liquid; this was delivered at the spout, and this spout was partly surrounded by the jacket. Water for refrigeration was supplied by a tube; this first circulated around the delivery-spout, and then found an exit through a rubber tube. Wiegand's still is shown in Fig. 177. It differs from Procter's principally in the method of joining the head of the still to the body;

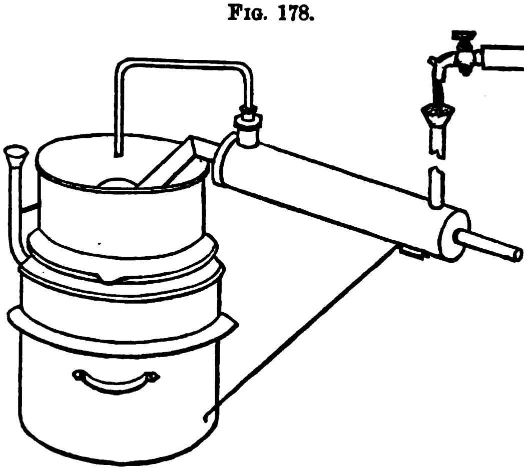
FIG. 177.



Wiegand's still.

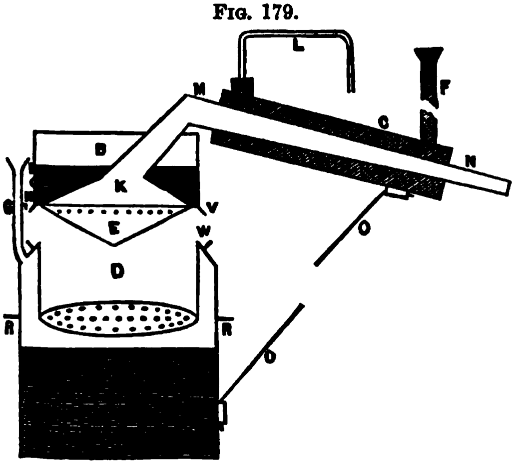
the sides of the head are tapering, so that the head can be pressed down tightly into the body, and with the aid of flaxseed lute a tight joint can be made; the feed-pipe is useful in charging the still, from the fact that it carries the liquid below the point where it would be likely to soil the condensing surface by splashing. Prof. Curtman's still (see Fig. 178) has several modifications about it which require special notice. The jacketing of the neck of the alembic, which is partially carried out in Procter's and Wiegand's stills, is extended so that it is converted into a Liebig's condenser; a bent tube, L (see Fig. 179), serves to convey water partially heated from contact with the vapor over into the head, B: this modification is especially intended to strengthen alcohol which is in process of recovery from weak tinctures; the water used for refrigeration circulates around the central tube, N, in the Liebig's condenser, and then finds an outlet into the head B by means of the bent tube L. The intention is to regulate the flow of water so that it shall be sufficient to condense alcoholic vapor passing through the tube, the heated water from L being at the same time of a temperature just above that of the boiling-point of alcohol (180° F.): the vapor of water coming over with the alcoholic vapor comes in contact with this heated surface, and, as the boiling-point of water is 100° C. (212° F.), the temperature of the condensing surface (180° F.) is sufficient to condense the vapor of the water, but not that of the alcohol; thus the water is separated and trickles back into the still, while the alcoholic vapor passes on into the condenser.

FIG. 178.



Curtman's still.

FIG. 179.



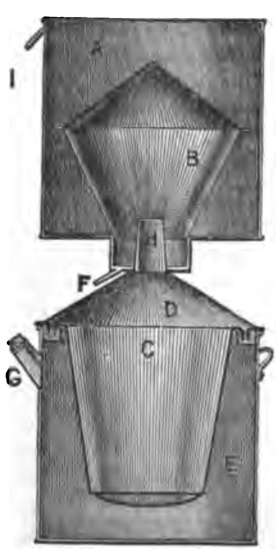
Curtman's still (sectional view).

A still on the alembic principle, made by Whitall, Tatum & Co., is shown in Figs. 179*a* and 179*b*. E represents the boiler, the pan C being used as a water-bath if required. The vapor rises through the tube H and passes into the chamber B, where it is condensed. The reservoir A is supplied with cold water, ice, or snow. The condensed liquid flows into a trough around the tube H and is discharged through F. At G there is a tubulure, closed with a screw-cap, through which the boiler can be supplied with water or the liquid which is to be distilled. The reservoir A is furnished with an overflow-pipe to conduct away the warm water as distillation proceeds. The still is simple in construction, but in practice it will be found advisable to attach a rubber tube to F to conduct the distillate away from the flame or other source of heat.

Fig. 179*a*.

Fig. 179*c* represents Game's still, made by J. M. Maris & Co., of Philadelphia. This still is also constructed on the alembic principle, the special features being the tubes *A* and *B*, as shown in the drawing, which are used to supply the still with liquid continuously during the distillation, the tube *B* connecting with the reservoir and furnishing air to replace the liquid as it flows into the still; the distilling chamber is shown at *G*, the pipe *A* descending nearly to the bottom of the still; the pipe *B* terminates in an inverted funnel near the bottom for the purpose of lessening the possibility of the air-pipe's becoming closed by the splashing of a thick liquid. The mouth of this cone is about three-fourths of an inch above the bottom, and it will be seen that when sufficient liquid has been run into the still from tube *A* to reach the bottom of tube *B*, no more liquid falls from the reservoir, and thus the amount of liquid in the still is always limited. When the distillation reduces the quantity of liquid so that it falls below the level of tube *B*, the liquid runs again from the reservoir, and thus the supply becomes automatic. The other parts of the still will be readily comprehended by inspecting Fig. 179*c*.

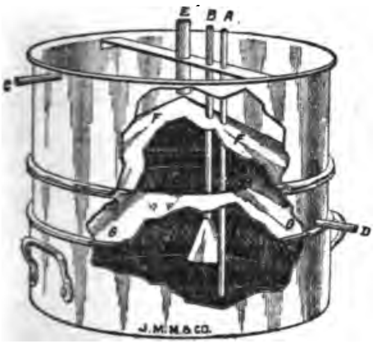
Fig. 179*b*.



The still shown in Fig. 179*d* was invented by Professor A. B.

Stevens, of Ann Arbor, Michigan. As will be seen from the illustration, it is made on the alembic principle, but it has several features about it which differ from the stills heretofore described. A light copper float, having a central rod or stem, is arranged in the still body, so that it will warn the operator when the liquid in the still has evaporated below the danger-point, previously adjusted. One of the best features about this still is the method of joining the two principal parts. The water-joint, which is never satisfactory in actual practice, is replaced here by a rubber rod ring, which fits into a circular groove and is held in place by clamps which are easily disconnected when the distillation is over. The methods of condensing and refrigerating are similar to those used in the preceding descriptions of alembic stills.

FIG. 179c.



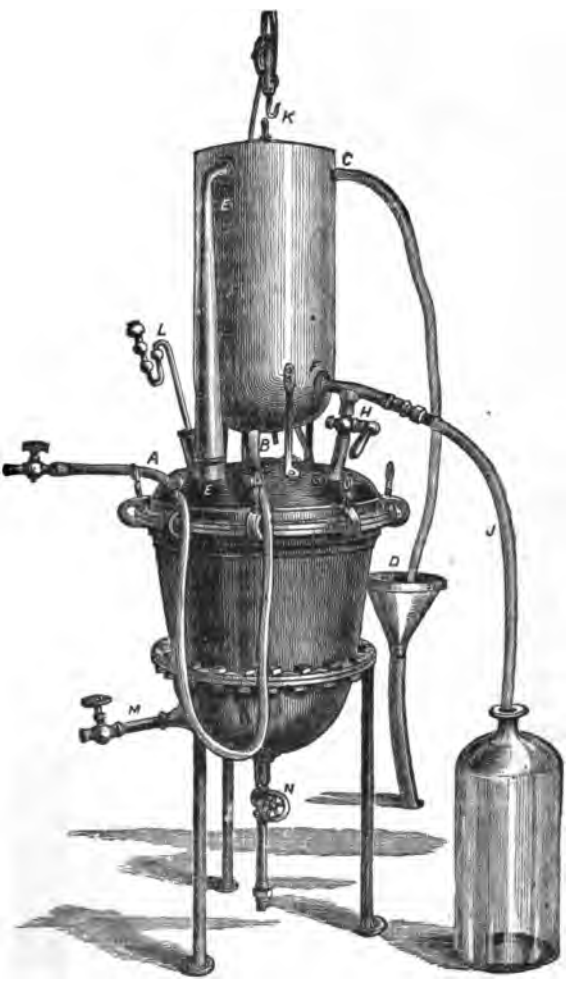
Stills constructed on the alembic principle have the disadvantage of having the cold water supply directly over the source of heat, and, as the latter is usually a coal stove or gas burner, the cold water used for refrigeration is rapidly heated, and much more is required to effect condensation than is the case with stills constructed on the retort principle. Again, the delivery-tube of the condensed liquid is immediately over the fire, and in recovering alcohol from weak percolates (one of the principal uses that pharmaceutical stills are put to) the danger from alcoholic vapor taking fire is great, if constant vigilance is not exercised. Many accidents have occurred through the neglect of the operator to keep a constant supply of cold water applied to the condenser. In cities and towns where water is supplied by a tap or faucet the flow is sometimes stopped by the shutting off of the water when workmen are making repairs to the pipes, and serious accidents are thus likely to occur through the water in the condenser becoming so hot that it will not condense alcoholic or ethereal vapors, which soon come in contact with the flame, and fire or explosion results. In all stills made on the alembic principle care should be observed to connect a metal or glass tube with the delivery-tube of the still, so as to lengthen it and convey the condensed liquid as far as possible away from the flame. Fortunately, water joints are now rarely employed: these usually consist of a gutter running around the top of the still body and filled with water; the head of the still is simply laid on top and held in place by a clasp;

FIG. 179d.

in a short time the heat evaporates the water, permitting the escape of vapor; hence watchfulness is required to renew the supply of water.

The distilling apparatus known as the Prentiss still, or alcohol reclaimer, possesses some peculiarities, a portion of the vapors being condensed immediately over the still: the still body has an upright column screwed to it; this connects by a union joint with the condenser, which is a single pipe bent into a zigzag form and terminating in a spout. The water intended for refrigeration is poured into the funnel at the top. The distinctive feature, however, is the series of perforated diaphragms which are soldered to a central rod and are placed inside of the column; these are asserted to impede the passage of and condense aqueous vapor when mixed with that which is alcoholic; the alcoholic vapor passes over and is converted into alcohol in the condenser, whilst the condensed water falls back into the still.

FIG. 180.



Rice's still and condenser.

A condenser contrived by Charles Rice, in which the block-tin worm is enclosed and placed immediately above the still head, is shown in Fig. 180. The still is heated by steam, which enters at *M*, *N* being the exhaust-pipe. The still head is constructed of copper. The condenser is a cylindrical copper vessel, with rounded bottom and closed top, having short half-inch tubes projecting from the bottom and from the top at *B* and *C*. There are two such tubes at the bottom, one for attaching the rubber hose, *A*, bringing the water; the second, shown in the cut immediately alongside the letter *B*, is closed with

a cork, and is used to permit the water to be emptied without detaching the hose from the other. At the top there are two tubes, one at *C* for attaching rubber hose to carry off the water into the waste-pipe *D;* the other, which is closed with a cork, is not shown in the cut, as it is on the back of the condenser.

The head of the still carries three short tubulures, only one of which is visible in the cut: this one contains a cork bearing the safety-valve, *L.* A second one is at the other side, for refilling the still when required, with another narrower tube intended for the insertion of a thermometer. The condensing pipe begins at *E,* where it rises from the head parallel with the condenser. It is made of copper as far as the point indicated by the upper *E,* where it is soldered to the *downward projecting* upper end of the block-tin worm contained in the condenser and emerging from it at *F.* This arrangement makes it impossible for any condensed liquid to come in contact with anything but block-tin. The worm inside the condenser is made by carefully winding block-tin pipe upon a round block of wood, taking particular care to give the coil a uniform downward descent throughout. After emerging from the condenser at *F,* it extends for a short distance, where the cut shows it to be connected to the separate block-tin pipe, *J,* by means of a union joint lined with tin. Half-way between *F* and the end proper of the worm the pipe is tapped, and a branch, carrying the faucet *H,* leads into the still at *G,* where it terminates under the centre of the head in the form of an ∽, forming a trap to prevent the escape of vapors by this passage. The object of this arrangement is to cause the condensed liquid to flow back into the still as long as the faucet *H* is open, or to collect it outside by turning off the faucet. Prolonged digestions with alcohol may be made by means of this apparatus without any loss of liquid. The head is attached to the still by means of a rubber washer and iron clamps, and when it is desired to remove it the water is allowed to drain from the condenser, the clamps are taken off, and the whole is hoisted up by the tackle *K,* and set on one side.

Pharmaceutical Stills—Retort Principle.—The method of condensing vapors by cooling them in a separate vessel connected with the still by a tube or tubes has been largely employed. The simplest plan is to connect the still head with a Liebig's condenser or a worm. The principal disadvantage of the former method is that considerable space is required in providing for the long tube and its refrigeration, and this is an important consideration in most laboratories. The disadvantage about the worm is one which is still greater, for, whilst space is economized, the spiral shape of the worm prevents the possibility of thoroughly cleaning it, and where a still is used for several purposes the odor and taste of the last liquid used in the still will be very apt to pervade and contaminate the distillate in process of collection. Kolle, in his endeavor to overcome these objections, retained the condensing tub, but, instead of using a worm, bent the pipe into a zigzag form and adjusted it in a vertical plane, the angles of the zigzag tube upon one side projecting through the sides of the tub: these projecting angles were made of separate, short pieces of tube, which were cemented to the condensing pipe. The objection to this condenser was the incon-

venience of breaking and making so many joints. Mitscherlich improved Gadda's condenser by constructing a condenser from two cylindrical vessels, the inner one removable and yet capable of being connected with the outer vessel by a tight joint: deficiency of condensing surface and the inconvenience of making vapor-tight joints were objectionable in this condenser.

From a consideration of the necessity for some new plan for condensing liquids in pharmaceutical stills, whereby the above objections could be overcome, the author was led, in 1872, to employ the principle of the tubular boiler for condensation (see Fig. 181). The body of the still is made of tinned copper; the bottom is not rounded, but flat, permitting it to stand securely on an ordinary counter; the bottom is made of heavier copper than the sides, and is fastened by tucking and folding, thus making a tight joint. A glass tube water-level on the side of the still shows when the liquid has been distilled to a dangerously low point, as well as too active ebullition, which may result in frothing. The glass tube may be removed from the rubber-tube connection by simply slipping it out, and if a thick residue in the still remains, it may be transferred to a bottle or dish by allowing it to escape at the lower tube orifice, thus avoiding loss of product by waste. The still body is connected with the top by a "twine joint," a flat brass ring being soldered to the top of the still body, and another of exactly the same size being soldered to the still top or dome. When the connection is to be made, a piece of soft, thick twine, two inches longer than the circumference of the ring, is soaked in water, and carefully laid upon the brass ring in such a way that the ends overlap; the top is then carefully laid upon the wet twine and securely fastened with clamps, which should be applied at opposite points at the same time, so as to bear equally.

FIG. 181.

Pharmaceutical still.

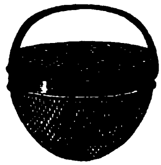
The *still top* differs from most others in having the opening for the escape of vapors drawn over to one side, instead of in the centre; by this arrangement the condensing surface of the dome is reduced to a minimum, and condensation *inside the still* is obviated as far as possible.

The construction of the condenser shows the application of a well-known principle which has been made to do service for an opposite purpose. The substitution of a number of tubes of small diameter for one large vessel is recognized as an effective means of rapidly producing vaporization (see page 131). The principle is of equal value in condensation. The condenser has seven parallel, solid block-tin tubes,

surrounded by a copper case: this case is perforated twice, and a short tube is soldered in at each extremity. To the lower tube a rubber tube is attached, which is connected with a cold-water faucet; a rubber tube is slipped over the upper short copper tube of the condenser for carrying off the water after it has served its purpose of condensing the vapors, which it does by circulating freely between the outer surface of the block-tin tubes and the inner surface of the containing case. The proportions of this condenser are so adjusted that if any liquid likely to be used is actively boiled in the still body, and cold water is running through the condenser, there can be no escape of condensable vapor at the exit-tube. In the condenser for the still holding three gallons the combined length of the tubes is about six feet, and about one hundred square inches of condensing surface are obtained: the condenser itself is fifteen inches long and about four inches wide. Straight, smooth, solid block-tin parallel tubes are used because of the convenience of cleaning them. A piece of cloth wrapped on the end of a rattan or stiff wire may be rapidly pushed through each tube, which serves to clean it when a very odorous liquid has been distilled, but usually it suffices to hold the condenser under a hot-water faucet for a few moments. The methods of connecting the various parts of the apparatus are simple. Two ground-brass joints are made, one at the point of junction of the condenser, with the still head top, and the other where the nose-piece is attached to the end of the condenser: these, on account of their comparatively small diameter, require no clamps or lute, and are vapor-tight. Where a moderate heat below the boiling-point of water is required, the still body is placed in a kettle; and, if the quantity of liquid to be distilled is not large, a round-bottomed, tinned-copper water-bath is clamped between the still body and still head, and the still body filled with water, the waste steam escaping through three apertures in the rim of the water-bath. This water-bath arrangement may be used in addition in making ointments. The automatic feeding attachment consists of a glass syphon, a rubber and a glass tube (the latter passing through a cork), and a pinchcock. The manner of using this is as follows. The still having been charged (about half full), the remainder of the liquid is placed in a vessel above the still body upon any suitable support; the syphon is placed in the liquid, then connected with the rubber tube carrying the pinchcock, and by suction or other means the syphon is filled and the pinchcock screwed down; the other end of the rubber tube is then connected with the glass tube running through the cork, which passes through the tubulure in the still head. Heat is now applied to the still body, the cold-water faucet is turned on to supply the condenser with cold water through the lower rubber tube, and when the distillate comes over in a steady stream a narrow strip of paper is pasted on the glass gauge-tube on the body of the still to mark the level of the liquid at starting. The pinchcock is then opened, and the level of the liquid in the still is regulated so that the liquid neither rises nor falls: this indicates that a stream of liquid from the reservoir above is running into the still exactly equal in volume to that of the distillate running from the exit-tube, and the apparatus may be left to take care of itself. The empyreumatic odor which dis-

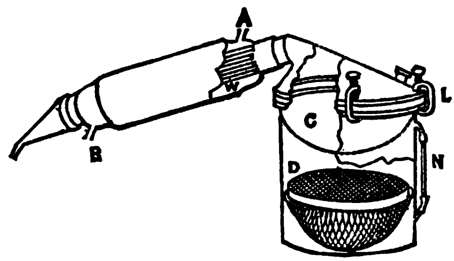
tilled and aromatic waters often possess, and which is usually caused by the solid substances lying in immediate contact with the hot still bottom, is obviated in this still by putting the substance into a hemispherical, coarse wire-sieve cage (see Fig. 182): the round bottom of the cage prevents any possibility of contact with the flat bottom of the still, whilst circulation of the water and vapor takes place through the meshes; a handle serves to lift it out when the distillation is completed. Fig. 183 shows a dissected view of the still, which illustrates the relative

FIG. 182.



Wire cage.

FIG. 183.

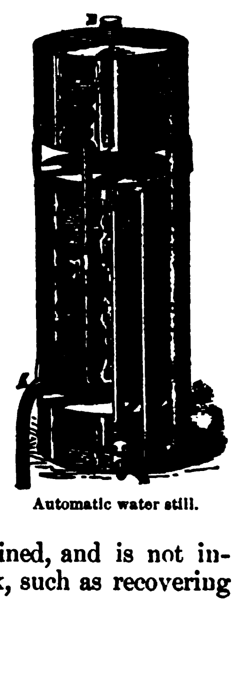


Pharmaceutical still (sectional view).

position of the parts,—D, the still body; N, tube level; L, clamp; C, water-bath; W, condenser; B, cold-water tube; A, exit-tube for warmed water.

A very useful automatic water still, devised by Herrick, is illustrated by Fig. 184. The lower vessel is the boiler, the middle one the condenser tank, the upper one the supply tank provided with a loose cover. Of the four pipes shown, A is the steam and condensed water tube, coiled, as shown in the condenser tank full of water, and delivering distilled water at A′; B is a pipe leading from the water level in the boiler to the top of the supply tank; C, a pipe, with cock, leading from the bottom of supply tank to the condenser tank; and D, a pipe leading from the top of the condenser tank to bottom of boiler. E is an opening, with air-tight stopper, for filling supply tank; and F, a cock to draw off hot water from boiler. The distillation of water proceeds, after it is once started, automatically. The advantages possessed by such a still are that a constant supply of distilled water can be furnished at a minimum cost. It can be operated by a gas flame, coal-oil stove, or by placing it upon the top of a range or stove, or in fact by any source of heat, and a very little care suffices to keep it running. It is, of course, only suited for distilling one liquid like water, where a constant supply of liquid can be maintained, and is not intended to be used for general pharmaceutical work, such as recovering alcohol from weak percolates, etc.

FIG. 184.



Automatic water still.

Fractional Distillation.—By this term is meant the process of separating by distillation liquids having different boiling-points or vapor-densities. When a mixed liquid, or one consisting of liquids of unequal volatility, is distilled, the first portion of the distillate contains a larger proportion of the most volatile constituent than of the others; hence the boiling-point is observed to rise as the distillation proceeds; and if a means is provided for collecting the distillate in several portions, or fractions, as they are called, fractional distillation offers a process by which liquids may be purified or separated. It is impossible, however, *in a single operation* to effect this separation of the component parts of a mixed liquid perfectly, because the distillate obtained at any period of the process is nearly identical with the vapor that is rising from the hot liquid, and therefore it is made up of the condensed vapor of that part of the liquid having a boiling-point at or below the temperature registered by the thermometer, plus the smaller amount of condensed vapor that is given off from the constituents having higher boiling-points, but which emit sensible vapors much below the point at which they actively boil. The relative proportions of the constituents of the mixed liquids have also a bearing in determining the composition of the distillate. By collecting the fractions carefully at stated temperatures, and redistilling each by itself, a more thorough separation may be effected, and this method is usually followed when such a separation is necessary. Upon the small scale one of the simplest forms of apparatus for fractional distillation is made by taking a gas bulb (a glass flask having a bent lateral tube in the neck), and, having adjusted a perforated cork in the neck for a thermometer, passing the tube of the gas bulb into a loosely-stopped test-tube, which is placed in a vessel surrounded with ice or properly refrigerated. A more efficient method is to connect the lateral ascending tube of a flask with the end of a worm, or a condenser so arranged that the liquid condensed at a certain temperature may run back into the flask; vapors having lower boiling-points pass through it uncondensed until they reach the second condenser, which is refrigerated to a degree sufficient to condense all the vapor. This method is used for manufacturing purposes upon the large scale.

Destructive distillation is the process of heating dry organic matter in a distillatory apparatus until all volatile substances are driven over: the residue is said to be carbonized. Destructive distillation is a process which is rarely employed by the pharmacist; hence it is not necessary in this work to treat the subject in detail. Glass vessels are not adapted to the process, because they will not usually stand the heat required without fracture, and the solid residue frequently fuses, is insoluble in water, and becomes so firmly attached to the bottom and sides that it cannot be removed without great difficulty. The best form of apparatus is an open vessel of cast iron, like a crucible, having a flange at the top, a dome with a corresponding flange, and a bent tube for carrying off the gaseous products: the connection is made with fire-clay lute and iron clamps. The manufacture of acetic acid, succinic acid, oil of amber, etc., affords illustrations of the use of this process, which is nearly always performed on a large scale.

CHAPTER VI.

SUBLIMATION.

SUBLIMATION is the process of distilling *volatile solids*. The product is termed a *sublimate*.

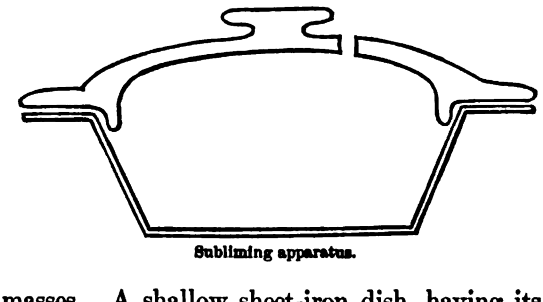
The objects of sublimation are—1, to purify volatile solids from admixed and fixed impurities, and, 2, to provide a convenient means of collecting volatile solids resulting from chemical reaction at high temperatures. The retorts or apparatus used may either be of iron, or of glass or stone-ware if the degree of heat necessary will admit of the use of the latter.

Sublimation is almost exclusively confined to operations which are conducted by manufacturers on the large scale. A process was formerly official for the sublimation of benzoic acid. It consisted in introducing benzoin into a shallow tinned-iron pan, and pasting over the top a sheet of filtering-paper. A pasteboard hood, shaped like a hat-box, was then fitted to the pan and tied or pasted with paper so that a tight joint was made; the apparatus was placed on an iron plate and subjected to a low but *uniform* heat: the vapors of benzoic acid passed through the pores of the filtering-paper, were separated from impurities, and, coming in contact with a cooler atmosphere in the hood, slowly condensed, often forming crystals of great beauty.

The temperature at which the condensation of the vapor is effected in sublimation has a very important influence in determining the physical character of the sublimate, and two kinds of sublimates are produced: 1. Cake sublimates. 2. Powder sublimates.

Cake Sublimates.—If the temperature of the condensing surface and of the air in contact is but slightly below that at which the volatile body is capable of subliming, the particles will be deposited in compact masses, like corrosive sublimate, commercial sal ammoniac, or carbonate of ammonia. Fig. 185 shows a simple apparatus for obtaining sublimates in cakes or masses. A shallow sheet-iron dish, having its upper edge turned out so that it forms a flat ring, is provided with an earthen-ware cover (it will be usually found more convenient to have

FIG. 185.



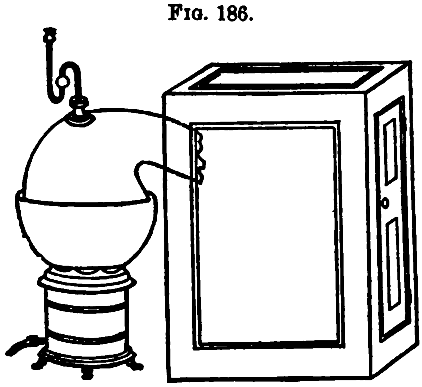
Sublimiing apparatus.

the iron dish made to fit the cover than the reverse), through which a hole is drilled to permit the escape of air (this may be done with a three-cornered file). After the substance which is to be sublimed has been placed in the iron dish, a piece of asbestos twine, slightly longer than the circumference of the ring, is laid upon it, and this is covered with a lute composed of equal parts of potters' clay and flaxseed-meal with sufficient water, the earthen-ware cover is pressed upon it until it adheres, and, when necessary, iron clamps are used to make a tight joint. The aperture in the cover is loosely covered with a cone of cardboard, the dish is placed in a sand-bath and gradually heated; the aperture is kept open during the sublimation by occasionally probing it with a glass rod; after cooling, the sublimate will be found adhering to the earthen-ware top in one cake or mass, and may be removed by a spatula. The earthen-ware top may be replaced by a sheet-iron one in cases in which the former would be likely to be fractured by excessive heat.

Powder Sublimates.—If the apparatus for conducting sublimation is so contrived that there is a marked difference between the temperature of the air in contact with the vapor and the subliming-point of the volatile body, the sublimate will be deposited very rapidly and in small particles, like calomel, sulphur, etc.

Fig. 186 shows a convenient apparatus for subliming camphor in powder. It is well adapted also for a lecture-room illustration of the process. A wooden case has two openings made in the sides to admit sheets of glass, which are secured in place by putty in the usual manner. One of the sides has a hinged door, which fits the frame snugly; the opposite side has a tapering circular aperture, which admits the shortened beak of a retort, as shown in the cut. Camphor is placed in the retort, a safety-tube is adjusted in the tubulure, and the retort is then placed deeply in a sand-bath on a good gas stove. Care must be observed in heating at first, and a Bunsen burner should be at hand to heat occasionally those portions of the top of the retort and the beak upon which the sublimate is forming. When the boiling-point is reached, the camphor vapor passes over rapidly, and at once falls in the form of powder upon coming in contact with the cold air in the chamber. The especial points to be observed are care in heating, and watchfulness that the beak of the retort does not become clogged with the sublimate. A judicious use of the Bunsen flame will soon melt the obstruction.

FIG. 186.



Subliming camphor.

The most important, and in practice the most difficult, part of the operation of sublimation is the regulation of the heat. The temperature of the condensing surface should always be below the fusing-point of the substance if distinct crystals or crusts are expected.

QUESTIONS ON CHAPTERS V. AND VI.

DISTILLATION AND SUBLIMATION.

DISTILLATION.

What are the elements of distillation?

How many times its weight of water at 20° C. (68° F.) are required to condense steam at 100° C. (212° F.)?

What two forms of apparatus are used in distillation?

What is the form of an alembic?

What is the body of it called?

What is the form of a retort?

Has a retort any advantages over an alembic, and if so, what are they?

What is a plain retort?

What is a tubulated retort?

Of what materials are retorts made?

For what purposes are the various kinds used?

What are the essential qualities of a good retort?

What are the advantages of using a flask for distillation?

What is the best shape for a flask?

How may glass tubes be cut?

How may glass tubes be bent?

What is a cork-borer, and how is it used?

How may rubber corks be cut?

What is the advantage of rubber corks?

What substitute for rubber corks may be made?

How may a satisfactory lute for closing joints be made?

How may bladder be used to join tubes?

How may paper be used to join tubes?

Is rubber superior to bladder for such purposes? If so, why?

How is it used?

What are receivers?

What are tubulated and quilled receivers?

What are adapters, and how are they used?

How may plain retorts be charged?

What is a Welter's safety-tube?

For what purposes are retort-stands used?

How may funnels or percolators be protected from the breakage due to contact with the iron rings of the ordinary retort-stand?

What is meant by bumping in distillation?

How may it be prevented or lessened?

What is a Liebig's condenser?

Describe the pinchcock contrived by Dr. Squibb.

Describe Mohr's spring pinchcock.

Describe Hoffman's screw pinchcock.

How may vapors be condensed when the ordinary condensers and a steady supply of water are not at hand?

What is a condensing worm?

What is the best metal to use for making it?

What objection is there to copper?

What objection is there to iron?

What objection is there to tinned iron?

What objection is there to earthen-ware?

What is the best material to use for pharmaceutical stills?

Describe Procter's still.

Describe Wiegand's still.

Describe Curtman's still.

Describe Prentiss's still.

Describe Rice's still and condenser.

What is the disadvantage of Liebig's condenser?

What is the disadvantage of a worm condenser?

Describe Remington's still and condenser.

What is meant by fractional distillation?
What is meant by destructive distillation?
What objection is there to using glass vessels in destructive distillation?
Give example of products made by destructive distillation.

SUBLIMATION.

What is sublimation?
What is the product called?
What are the objects of sublimation?
Of what material are the retorts or apparatus usually made?
What effect does the temperature of the condensation point of the vapors of solids have upon the character of the sublimate?
What is the difference between a cake sublimate and a powder sublimate?
How are cake sublimates obtained?
How are powder sublimates obtained?
What is the most important point to be observed in the operation of sublimation?

CHAPTER VII.

DESICCATION.

Desiccation is the process of depriving solid substances of moisture, and in pharmacy should be effected at as low temperatures as possible. (See Exsiccation.)

The objects of desiccating medicinal substances are threefold: 1. To aid in their preservation. 2. To reduce their bulk. 3. To facilitate their comminution.

1. To Aid in their Preservation.—Chemical salts frequently contain water either chemically or mechanically combined with them. An elevation in the temperature, or the absorption of water from moisture present in the air, will in some instances cause *deliquescence*, whilst in others contact with a dry atmosphere will cause *efflorescence*, due to the evaporation of chemically-combined water; hence such salts in their natural condition are unstable; they are much more permanent when dried. Vegetable drugs soon decompose or become mouldy if allowed to remain in a moist condition, and desiccation is absolutely necessary to preserve them.

2. To Reduce their Bulk.—If desiccation is performed successfully, —*i.e.*, at properly-regulated temperatures under certain precautions,— the substance is merely deprived of water without suffering any loss of medicinal activity, and the reduction in bulk that follows is a practical advantage which results in adding to the strength of the medicinal substance.

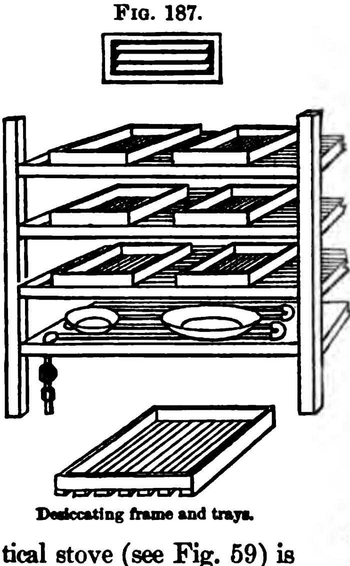
3. To Facilitate their Comminution.—The presence of water gives to drugs an elasticity and ability to resist disintegration, which in some cases interfere greatly with the process of bruising, grinding, or reducing the drug to particles. One of the first steps in comminution is to dry the substance thoroughly in order to make it brittle or crisp.

The apparatus employed in desiccation is frequently of the simplest character, and the heat is usually not especially created for the purpose, for it is most economical to use the waste heat from kitchen fires or cellar furnaces or the diffused heat in lofts or unused attics. There can be no objection to this if care is taken to provide protection for the substance from dust, light, and injury during desiccation. Herbs may be dried by tying them in bunches and suspending them to the attic ceiling or to the rafters of a barn during summer weather, and this is an excellent method usually, notwithstanding its slowness, because there is no danger of the heat being strong enough to cause loss of valuable volatile principles. Roots, barks, and leaves may be dried by spreading them out upon clean tables or floors in a dry room and turning them repeatedly, so as to

expose fresh surfaces to the dry air. On the large scale, and in the laboratory, special apparatus must be employed. Fig. 187 illustrates a portion of the interior of a laboratory drying-room. Live steam is passed through the pipes when higher temperatures are needed, but waste or exhaust steam from steam kettles is economically and properly used. Trays of suitable size, containing the substance to be dried placed on thin muslin, are set upon the shelves of the rack. Ventilators should be provided to carry off the moist air. The space immediately over the steam boiler can often be economically used for a drying-room by placing a sheet-iron floor over it to secure the radiated heat, and arranging racks and trays upon it in convenient positions, or by placing the drugs in barrels in which the heads have been replaced by wire netting, or by simply enclosing the drugs in coarse bags which permit the escape of moisture.

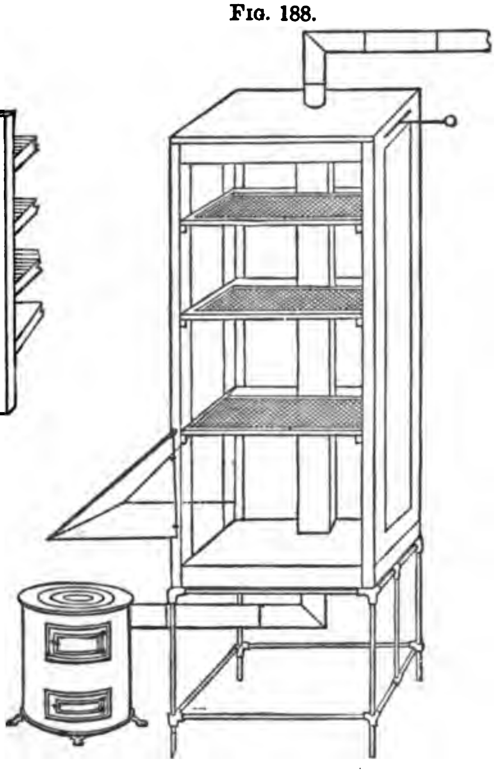
Fig. 188 shows a pharmaceutical drying closet which is simple, economical, and easily made: the heat from the flue of the pharmaceu-

FIG. 187.



Desiccating frame and trays.

FIG. 188.

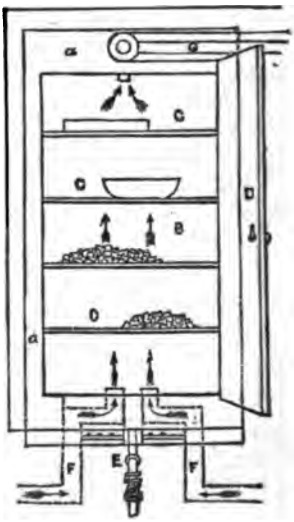


Pharmaceutical drying closet.

tical stove (see Fig. 59) is utilized. The frame which supports the closet is made of half-inch steam-pipe, and to the uprights the retort-rings (see Fig. 164) may be clamped, and the filtration of chilled oils in winter-time, or warm filtration or percolation of any kind, may be carried on. The sides of the closet are of thick paper, felt, or asbestos cloth, tacked to a wooden frame, and cleats at convenient intervals are arranged for the trays to slide upon. The stovepipe from the stove is connected with the flue at the bottom of the drying

closet, and the heat from the smoke and gas passing up the flue is thus utilized; the hood may be dropped over the top of the stove when the latter is not needed for other purposes, the heated air carrying the moisture from the substance to be dried, rising and escaping at the ventilators. Lozenges, crystallized salts, extracts, filters, etc., may all be dried in this cheap and simple closet. One practical point about desiccation is frequently overlooked. It is that substances which are being dried must be repeatedly turned over, so that the parts underneath shall be exposed to the external dry atmosphere. In the case of salts, crystals, and other bodies, if this is not done, a hard crust is formed upon the surface which is often difficult to break up.

FIG. 189.



Drying closet (gas heat).

A convenient drying closet, suitable for a small laboratory, is shown in Fig. 189. It was contrived by T. Edward Greenish, of London; it is heated by gas, and is intended to fit into a recess in the wall. The drying closet, B, is made of thin sheet-iron, and provided with wire shelves, C, and a tightly-fitting door, D. The closet is made of such a size that when fixed into the recess in the wall a space of about two inches is left at the back, sides, bottom, and top, the space being covered in front by the flanges *a, a;* these constitute, with the door, the front of the closet. E is a gas-burner supplied from the pipe, and F, F are two air-pipes which enter at the bottom of the closet: these pipes draw their supply of air from an *external* source, and thus the laboratory fumes and odors cannot taint the substances which are to be desiccated. The upper ends of these tubes are covered with a layer of sand two inches deep, forming a sand-bath.

FIG. 190.

Drying oven.

The gas being lighted is supplied with air from the front, and the heated air, together with the products of combustion, passes around the closet through openings made for that purpose in the sides and back of the gas-chamber, up the space between the closet and the wall to a pipe, G, and thence to a chimney. The substances to be dried, or the liquids to be evaporated, are placed either upon the shelves or upon the sand-bath. The air which enters by the pipes F, F, slightly warmed by the sand, will carry up any vapor therefrom to a pipe at the top of the closet, and thence to the pipe G. In order to regulate the draught of air at the back and sides of the closet, and thereby to adjust the degree of heat, the pipe G

is provided with a circular damper, and the gas-chamber also has in front of it an arrangement for regulating the supply of air to the gas, thus preventing sudden fluctuations of temperature. By these means the heat of the closet may be readily adjusted. If the temperature of the upper shelf is 82° F., the next lower will be 85° F., the next 88° F., the lower one 92° F., whilst the sand-bath will register about 130° F.

A drying oven, intended for drying precipitates in analytical work, but very useful for desiccating small quantities of pharmaceutical substances, pills, lozenges, or drugs like squill, saffron, castile soap, etc., is shown in Fig. 190. Water is poured into the tubulure at the top, and a Bunsen burner furnishes the requisite heat when placed so that the flame touches the under surface, the legs of the oven being long enough to permit its use.

Loss in Drying Medicinal Substances.—When drugs are powdered, loss is always experienced. This arises partly from the escape of fine particles, but principally from loss of moisture in drying. Again, in powdering almost all drugs, a portion remains which resists disintegration. This is called by the miller "gruffs," and is usually worthless and should be thrown away: the gruffs are frequently kept, however, and sent with the next lot of the same drug to be ground at the mill. The dose of a powdered drug is usually somewhat less than that of the same drug before it was pulverized, because the weight it has lost generally represents inert matter, water, etc. Powdered ipecac is a good illustration of this. The active principle *emetine* resides in the starchy cortical portion of the root; the internal ligneous cord constitutes the "gruffs" of ipecac, and is inert. The exception to this is the case of those drugs containing an active volatile constituent, like the aromatics, cloves, cinnamon, nutmeg, or like asafetida, myrrh, cubeb, etc. These drugs, when powdered, generally contain less of their active constituents than they did before they were ground: the volatile oils to which their virtues are due are driven off to a greater or less extent by the amount of heat necessary to make them brittle enough to be readily pulverized. The U. S. Pharmacopœia recognizes the importance of this fact by directing myrrh, and not powdered myrrh, in the compound iron mixture; asafetida, and not powdered asafetida, in the asafetida mixture; and in the compound tincture of cardamom by the direction to mix the unpowdered drugs, cardamom, cinnamon, caraway, and cochineal together, and reduce the mixture to powder, in preference to mixing the separate powders of these drugs. If care is exercised in desiccating, the powders of most drugs possess all their medicinal properties, and in many cases they will retain indefinitely these properties unimpaired if they are properly preserved and not unduly exposed to air, light, or moisture.

The practice of some drug-millers of establishing a loss in the weight of a drug as a regular standard, and then making up the deficiency by adding the same amount of some inert substance, is reprehensible. That the amount of moisture present in different lots of the same drug varies greatly may be seen by a glance at the following table, compiled by Mr. T. J. Covell from accurate records obtained from Dr. E. R. Squibb's drug-mills. The table is valuable because it represents the loss in powdering considerable quantities of drugs:

Table showing Loss in Powdering Medicinal Substances.

Substance.	Greatest Loss per cent. on any Single Lot.	Smallest Loss per cent. on any Single Lot.	Average Loss per cent.
Acacia	1.88	0.40	0.83
Acacia (granulated)	1.67	1.08	1.35
Aloe Capensis	19.31	7.09	11.13
Aloe Socotrina	24.62	10.00	17.31
Acidum Tartaricum	2.50	0.54	1.06
Buchu	4.10	0.20	2.00
Canella	3.07	0.50	1.77
Cantharis	6.22	0.63	2.05
Cardamomum	7.10	5.00	6.02
Cassia	2.90	2.26	2.61
Catechu	1.30	0.86	1.08
Cinchona Flava	3.75	1.18	2.57
Cinchona Pallida	2.22	0.96	1.73
Cinchona Rubra	1.72	1.24	1.58
Cubeba	3.55	1.99	2.4
Ergota	5.72	0.00	3.62
Extractum Glycyrrhizæ	13.06	8.14	10.45
Gambogia	2.46	0.74	1.35
Gentiana	11.79	9.20	10.23
Gentiana (ground)	8.30	1.56	5.09
Ipecacuanha	3.66	0.64	1.91
Iris Florentina	9.00	1.10	6.22
Jalapa	12.24	2.95	9.58
Myrrha	8.81	3.59	5.80
Opium	22.85	9.91	19.61
Podophyllum	1.15	0.49	0.75
Potassii Chloras	2.70	1.52	2.01
Potassii Bitartras	1.11	0.05	0.38
Pulvis Ipecacuanhæ et Opii	1.63	0.63	1.05
Rheum	3.40	0.10	1.74
Saccharum Lactis	0.85	0.70	0.78
Sapo	18.05	11.70	15.92
Sarsaparilla (Rio Negro)	0.96	0.35	0.70
Scammonium	5.65	1.33	2.70
Scilla	16.45	10.83	13.60
Valeriana	1.51	1.45	1.48
Tragacantha	7.38	6.47	6.93
Zingiber (nigrum)	3.72	3.13	3.43
Zingiber (album)	11.74	8.57	9.70

CHAPTER VIII.

COMMINUTION.

Comminution is the process of reducing drugs to particles, or breaking up their state of aggregation.

Medicinal substances in their natural state require to be mechanically divided in order to facilitate the action of menstrua or solvents, or to permit their administration *per se* in the form of fine powders.

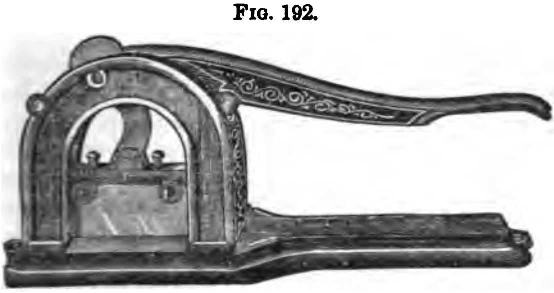
A simple illustration is offered in the case of alum. A solid lump of alum weighing one ounce, if added to a pint of water, will not dissolve nearly so quickly as will one ounce of the same alum in the same quantity of water *if finely powdered.* Vegetable substances offer very variable degrees of resistance in powdering, owing to the proportion and toughness of their ligneous fibre and the amount of cellular tissue.

Under the head of comminution will be grouped the various mechanical operations used in pharmacy by which the surface of solid substances is increased, whether by cutting, rasping, grating, chopping, crushing, rolling, stamping, grinding, powdering, triturating, levigating, elutriating, granulating, or similar processes.

By far the greater number of substances employed in medicine belong to the vegetable kingdom, and, whilst many of the processes of comminution used for these are also applicable to the chemical substances of the materia medica, it will be necessary in the following chapter to note the apparatus specially adapted to each class.

Cutting, Slicing, and Chopping.—This process is used principally in bringing roots, barks, leaves, herbs, etc., to the proper condition for treating with suitable solvents. For very small operations either the pruning-knife or pruning-shears answers a good purpose. The tobacco-knife or herb-cutter shown in Fig. 192 is well adapted for the purpose. It should be observed, however, that the principle upon which a knife operates successfully should be carefully carried out in constructing apparatus designed for cutting: direct pressure without a slight drawing or sawing motion is not effective; therefore those knives which have guides arranged

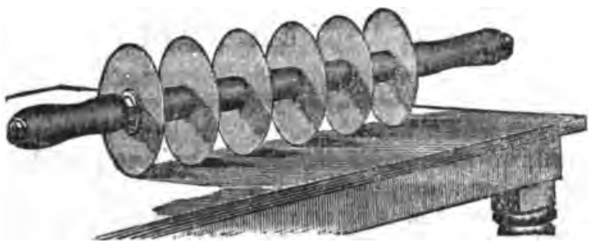
Fig. 192.



Herb-cutter.

so that the knife-edge sunders the particles at an angle are greatly preferred. Fig. 193 shows a roller knife which is very serviceable. It is made by W. Weber, Evansville, Indiana. The circular blades or knives are made of the same quality of steel that is used for saws, and

FIG. 193.



Roller knife.

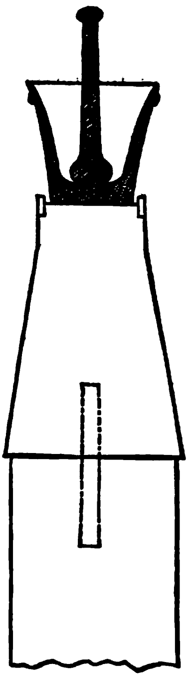
are mounted upon a shaft, being separated by a series of spools or collars. The handles are of wood and mounted on the ends of the shaft, so that they are loose upon the shaft, thus permitting the handles to be grasped tightly whilst the roller knife revolves. The substances to be cut are placed upon a smooth board and the roller knife passed over them with more or less pressure. Upon the large scale drugs are cut with hay-cutters, implements usually consisting of four or more circular blades fastened to a shaft and revolving at the end of a trough, down which the substance that is to be cut is gradually fed. Sarsaparilla root is cut in this way before it is contused.

Rasping or Grating.—A half-round rasp (see Fig. 147) or a nutmeg-grater is very useful at the prescription counter, as it frequently enables the pharmacist to prepare a small quantity of a powder for a prescription in case the regular stock-bottle is found empty or a very fresh powder is needed. The small pocket pepper-mills used by European travellers for grinding whole pepper at the table will be found especially useful.

Contusion, or bruising, is an operation very frequently resorted to. It may be defined as the process of reducing a drug to particles by striking it a succession of blows. The instrument generally employed is the well-known mortar and pestle, which, for contusing drugs, should be made of cast iron, bell-metal, or brass. The shape best adapted for this purpose is shown in Fig. 194, the mortar being represented on a mortar-block. The bottom of the mortar should be flat and heavy, so that it may rest firmly upon whatever base it is placed; the sides should flare slightly, but the mortar should be so deep that substances will not be easily forced out on to the floor by the blows of the pestle. A leather or wooden cover should be used upon the mortar when corrosive or irritating substances are contused. The pestle should be heavy and sufficiently flat on the under surface to permit the convexity nearly to coincide with the concave surface of the mortar. The inner surface of the mortar should be tinned, to prevent rusting and facilitate cleaning. The best support for an iron mortar is the top surface of a hard-wood post six inches in diameter and of sufficient length to pass from the top

of the floor into the cellar and rest on the ground. A turned wood mortar-block two feet high should rest upon the post; this block should have a flat iron hoop upon the top projecting half an inch above the surface, as suggested by Dr. H. T. Cummings, whilst the bottom should have an inch hole bored up through the centre for the distance of twelve inches; an inch wooden pin, two feet long, should be firmly fixed in the centre of the post for the distance of twelve inches, which would leave twelve inches of the wooden pin projecting above the floor. Now, if the mortar-block is placed over it so that the pin enters the hole in the base, it will be found that a solid foundation is provided for resisting the blows of the pestle, and jarring and vibration, so destructive to balances and fragile apparatus, are prevented (see Fig. 194).

FIG. 194.



Mortar and pestle.

When for good reasons the post-support cannot be used, the next best base is a deep, strong box filled with dry sand. The principal objection to this is the constant loss of the sand and the inconvenience of having it spilled on the floor. When it is necessary to use an iron mortar and pestle for a continuous operation, for a considerable length of time, it will be found advantageous to connect the upper part of the pestle with an elastic wooden spring attached to the ceiling, so that the labor of lifting the pestle will be lessened. This spring is preferably made from a tapering hickory strip seven or eight feet long and four inches wide at the base, the rope connecting the pestle with the end of the spring being of such length that the pestle barely touches the bottom of the mortar when the spring is stretched to its utmost tension. On account of the large number of mills scattered over the country, established for grinding drugs, and the increase of facilities for grinding and powdering drugs on the large scale, the skilful use of the mortar and pestle by the pharmacist must be regarded as a lost art. The necessity for thoroughly drying drugs before subjecting them to comminution has already been mentioned. (See Desiccation.)

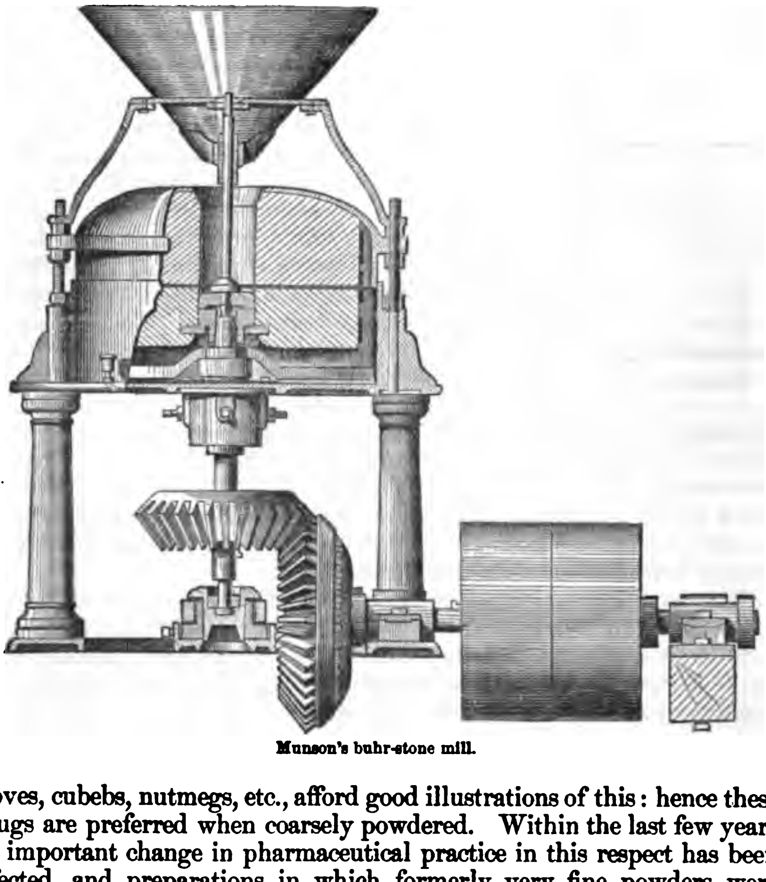
Wooden mortars and pestles are occasionally used for contusing soft bodies, like prune pulp, almonds, recent fleshy roots, substances that are affected by iron, etc. Lignum-vitæ is a very hard and suitable wood for this purpose, although boxwood is preferable when it can be procured, because it has less tendency to split.

Marble mortars are also used for operations of a similar character on a somewhat larger scale; but care must be used to avoid putting substances containing acid into such mortars, on account of the reaction upon the marble and the consequent contamination of the product.

Grinding and Pulverizing.—The former term is applied to the reduction of a substance by mechanical means to *coarse* particles, the latter to the production of *fine* particles. These processes are the most important of any grouped under comminution. At present they are

very largely carried on by drug-millers. It is necessary for the pharmacist to be familiar with the methods employed, however, if intelligent judgment is to be exercised in the subsequent treatment of the vegetable and mineral substances of the materia medica. Before pulverizing a substance it must be dried, and the desired fineness of the powder determines the character of the preliminary treatment. In order properly to grind or powder substances upon the large scale, special knowledge and experience are required; previous acquaintance with the methods best suited to accomplish the object on the small scale, whilst useful to some extent, will be found inadequate. If a drug is to be coarsely ground, the necessity for thoroughly drying it is generally not so pressing as when a fine powder is to be made of the substance; drugs containing volatile oils are apt to be rendered worthless if they are dried sufficiently to enable them to be ground to a fine powder. Myrrh,

FIG. 195.



Munson's buhr-stone mill.

cloves, cubebs, nutmegs, etc., afford good illustrations of this: hence these drugs are preferred when coarsely powdered. Within the last few years an important change in pharmaceutical practice in this respect has been effected, and preparations in which formerly very fine powders were directed are now ordered to be made from coarse powders: the processes for extracting the soluble principles having been greatly improved, the

necessity no longer exists for using the very fine powders, and hence volatile principles are not sacrificed.

DRUG-MILLS.

The Buhr-stone Mill is very extensively employed in drug-milling. There are two kinds, termed respectively under-runners and upper-runners. The principle upon which this mill operates is that of reducing the substance to particles by the friction and contusion that follow the delivery of the substance in the contracted space formed by a rapidly-revolving stone disk, brought in nearly close contact with a similar disk which is stationary. In the under-runners the upper stone is stationary and the lower stone revolves, the upper stone having a central circular opening through which the substance is fed, as shown in Fig. 195, the under stone being connected with the shaft. In the upper-runners the lower stone is stationary, the upper stone being perforated as in the under-runners. In both, the stones revolve horizontally. The stone used must be very hard. The best buhr-millstone is obtained from the old and celebrated quarries of La Ferté-sous-Jouarre, in France. The surfaces of the millstones are crossed with "furrows," which pass from the centre to the circumference, as shown in Fig. 196. The object of the furrows is to provide a means for the passage of the ground particles to the outer circumference and to the trough: this is accomplished through the centrifugal force and current of air caused by the rapid revolution of the stone in motion. The fineness of the powder is regulated by raising or lowering one of the stones, this of course increasing or decreasing the space between them; the character of the powder is also influenced by the dressing of the stone. Fig. 195 illustrates one of the best of the modern buhr-stone mills,—Munson's under-runner.

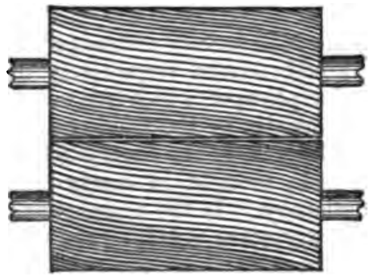
FIG. 196.

Buhr-stone.

Roller-Mills operate by crushing, or crushing and cutting, the substance. In their simplest form they consist of two smooth-faced iron rollers revolving in opposite directions, which can be brought into close contact by regulating screws. The principle has been extended and improved in modern milling, so that for grinding certain drugs this mill gives excellent results. The rollers are now made of steel, chilled iron,

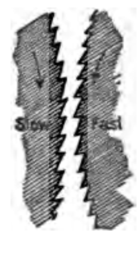
or biscuit (porcelain), and are corrugated or ribbed to suit special purposes. The sections of these corrugations are serrated, undulated, or crenated. The rollers revolve in the same direction or in opposite directions, and at equal or different speeds. Fig. 197 shows the position of the grooved rollers, and Fig. 197*a* shows a sectional view of the same. A roller drug-mill, operated by steam-power or by hand, is made by W. Schroeder & Co., of Leipsic, Germany. The rollers have sharp oblique furrows upon their surfaces, and extra rollers are supplied to suit special purposes for grinding very fine powders, etc. (N. R., 1878, p. 336.) Allaire, Woodward & Co., of Peoria, Illinois, use with great success a corrugated roller-mill in grinding nux vomica.

FIG. 197.



Grooved rollers.

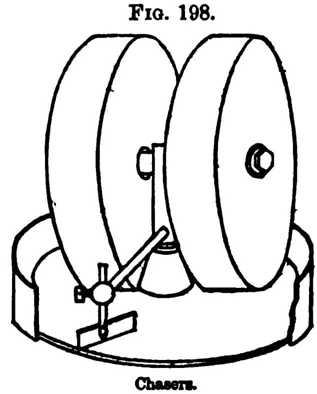
FIG. 197*a*.



Grooved rollers (cross-section).

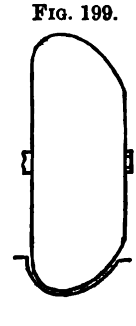
Chaser-Mills are so called because two heavy granite stones, mounted like wheels and connected by a short horizontal shaft, are made to revolve or *chase* each other upon a granite base (see Fig. 198). The stones are discoid, and the grinding surfaces are the circumferential edges of the stones and the surface of the granite base; an iron cylinder, called a "curb," surrounds the circular base, and a "scraper," made of iron and adjusted at an angle, is connected with the shaft. It is evident that if the substance to be powdered is delivered upon the granite base in the path of the rapidly-revolving stones it must speedily be reduced to powder, not only on account of the crushing weight of the heavy stones, but also because of the attrition caused by the outer edge of the stone travelling through a longer distance than the inner edge. In some mills the stones having flat, grinding surfaces have been replaced by stones having curved surfaces, and the flat base by a circular gutter curved to correspond with that of the surface of the stone: in this way the grinding surfaces have been greatly increased and rapid pulverization facilitated. Fig. 199 shows the shape of the stones of this form in use in Dr. Squibb's laboratory. In practice the chasers are enclosed in a tight box or small room, closed with air-tight doors, and the substance to be powdered is fed in from the top by an

FIG. 198.



Chasers.

FIG. 199.



Chasers (curved grinding surface).

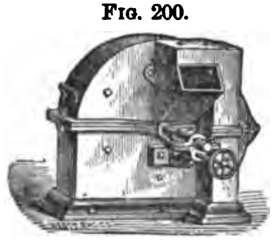
elongated funnel, the spout of which delivers the material immediately upon the path of the stones. The height of the curb is increased by pasting heavy paper around it, and the fineness of the powder is influenced by the height of the curb. The revolution of the chasers produces an upward current of air; this carries over the lighter particles, which fall outside the curb and are subsequently collected as a fine powder; those particles which are larger are of course heavier and cannot rise to the height of the curb, but fall back under the stones to be reground: in this way refractory substances can be reduced to very fine powder. Chasers are more largely employed in making "dusted" or very fine powders than any other form of pulverizing apparatus.

Mills with Iron Grinding Surfaces.—Many mills have been constructed from time to time to suit special purposes: these cannot be noticed at length in a work having the scope of the present one. *Barrel-mills* have been used. These consist of strong barrels lined with sheet-iron, supported by strong iron shafts attached to the heads. The substance to be comminuted is placed in the barrel, and large round iron balls, like cannon-balls, are introduced: upon revolving the barrel rapidly, disintegration is effected. This principle is used also in pulverizing dried extracts and friable substances. A hollow circular iron ring, having a diameter slightly larger than that of the cannon-ball which is placed inside with the charge of substance to be powdered, is made to revolve rapidly; the inertia of the cannon-ball and the friction render its speed less than that of the ring, and the substance is quickly ground. The "Bogardus" mill is constructed on a very ingenious principle: the grinding surfaces are two horizontal chilled-iron plates, the lower one revolving, the upper one stationary; both have corrugations having sharp edges, arranged concentrically. The peculiarity of this mill is that the centres of the grinding-plates are not directly over each other as in buhr-stone mills, but the centre of the lower plate is placed a few inches to one side: by this arrangement the substance to be ground is caught by the ring-edges of the revolving plate and dashed against the cutting-edges of the stationary upper plate at an angle, the effect being to incise it as if cut with scissors and crush it at the same time.

Mead's Disintegrator differs from the mills thus far considered in the principle of construction, in the character of the grinding surfaces, and in its method of operation. The grinding is effected by hardened steel beaters riveted to a steel disk, which revolves vertically between corrugated rings; the beaters are placed on the side of the disk nearest to the feeding-trough, and catch the material as it enters the mill, beating it with great force against the corrugated rings until it is fine enough to pass between the disk and the face of the rings; as soon as it passes here, it is on the side of the mill from whence it is discharged, and all that is fine enough is immediately driven out by the beaters on the back of the disk. That portion of the substance which is not fine enough is caught by the beaters and beaten against the screens until sufficiently fine to pass through. The screens are two inches in width, and extend around three-fourths of the diameter of the mill: they are made of square steel bars, and present a grinding surface to the beaters,

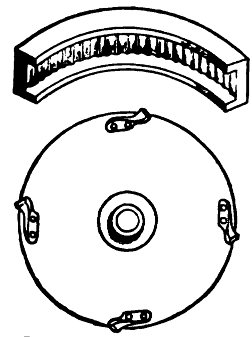
but there is sufficient space between them to permit the passage of fine particles. The substance, as it is ground, falls into a receiving-box below the mill, or is discharged through the floor into a room below. One prime requisite in running this mill is high speed: the disk must make three thousand revolutions a minute. The disintegrator is capable of grinding one hundred and fifty pounds of Ignatia bean, or six hundred pounds of wild-cherry bark, in one hour. Fig. 200 gives an illustration of the mill, whilst Fig. 201 shows an enlarged view of the revolving disk, and a section of the screens immediately above.

Fig. 200.



Mead's disintegrator.

Fig. 201.



Revolving disk and screens.

Hand-Mills.—It is more difficult to construct a drug-mill for the general use of the pharmacist than one for the special purposes of a drug-miller. The latter has the choice of a buhr-stone mill, chaser, disintegrator, iron mill, etc., which he can adjust to suit the character of the substance he desires to grind. The pharmacist's drug-mill, on the other hand, is expected to do all kinds of work rapidly and well. It must, therefore, be capable of ready adjustment, possess durability, and have cutting surfaces not quickly dulled, and working parts not liable to get out of order.

It is not easy to realize that every medicinal substance has an individuality of its own, but he who neglects the study of the physical characters of the substances of the materia medica can never expect to overcome successfully the obstacles which stand in the way of disintegration. Hand drug-mills may be divided into three classes: 1. Those having vertical grinding surfaces. 2. Those having horizontal grinding surfaces. 3. Those having conical grinding surfaces. They have the following points in common: iron is the principal material of construction, the grinding surfaces are of hardened iron or steel and consist of teeth arranged in concentric rows, and the regulation of the fineness of the powder is effected by a screw or screws, by which the plates are made to approach or recede from each other.

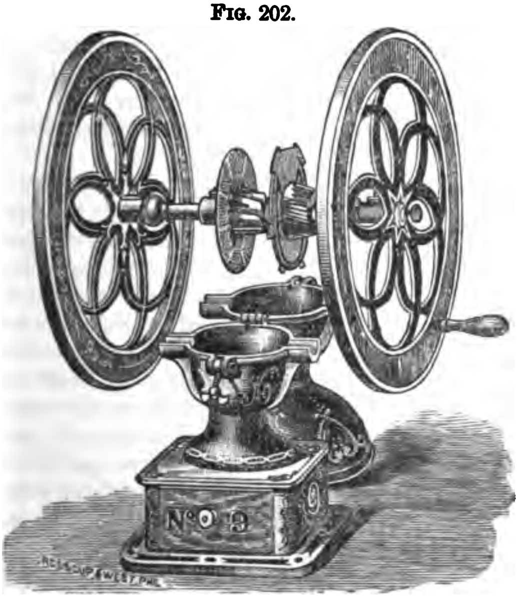
1. Hand Drug-Mills with Vertical Grinding Surfaces.—*Swift's Mill* (old style).—This hand-mill has been in use longer than any other in the American market. Its introduction marked an era in the history of pharmacy, and, although superseded now by greatly-improved mills, it is still remembered with grateful feelings by those of the present generation, who had been previously accustomed to laborious mortar practice. In this mill there are two vertical grinding-plates, one of which is stationary, whilst the other is connected with the horizontal revolving shaft; a conical breaker is also attached to the shaft, and when in position it is immediately below the lower opening of the hopper; a fly-wheel with a handle is bolted to the outer

end of the horizontal shaft, and furnishes the power required. The teeth are of iron and arranged in concentric rows, and the plates are made to approach each other or to separate by an adjusting-screw. The supports of the mill are of ash or oak, and are durable and firm. The principal disadvantages of this mill are the difficulty of cleaning it, its slow action, its liability to become clogged, and the absence of a tight box or drawer to receive the ground drug. Two improvements have been made in the Swift's new-style mills: in one the fly-wheel has been made larger and heavier, in the other a double fly-wheel has been attached.

Troemner's Mill, whilst constructed upon the same principle as Swift's, is much more thorough in its action, and requires less labor to operate it, than Swift's mill (old style). It has vertical plates, a thumb-screw to regulate the fineness of the powder, a heavy fly-wheel, and a close-fitting drawer to receive the powdered drug. It is not so easily cleaned, however, as the next mill to be mentioned.

The Enterprise Mill.—The introduction of this mill, in 1875, gave an impetus to the manufacture of hand drug-mills which is still felt: the application of several new principles, and the extension and improvement of some valuable old ones, at once gained the attention of practical pharmacists. The great advantage possessed by this mill over those in the market at the time it was introduced was the ease with which the interior and the working parts could be reached. The principle of supporting the grinding-plates upon a horizontal shaft, to the extremities of which heavy fly-wheels were attached, and providing a means for lifting all the working parts out of the interior to facilitate their cleaning, were novel features. Fig. 202 so thoroughly illustrates this mill that it is hardly necessary to dwell upon its other features. The left-hand grinding-plate revolves, being geared to the shaft, whilst the one on the right hand is stationary: when in position for grinding they are, of course, nearly in contact. The opening of the interior is effected by simply turning the thumb-screw in front. A smaller mill is shown in Fig. 203. It is very conveniently used at the dispensing counter.

FIG. 202.



Enterprise drug-mill.

2. HAND DRUG-MILLS HAVING HORIZONTAL GRINDING SURFACES.—*Thomas's Mill.*—This was one of the first hand drug-mills

made upon this principle. There are two horizontal grinding-plates, the lower one revolving and the upper one stationary. A vertical shaft, which is geared to a horizontal shaft by bevel-wheels, communicates the power to the lower plate upon revolving the fly-wheel. The absence of a closed receptacle, and the difficulty of quickly cleaning the grinding surfaces, are the principal objections to this mill.

Fig. 203.

Drug-mill (dispensing).

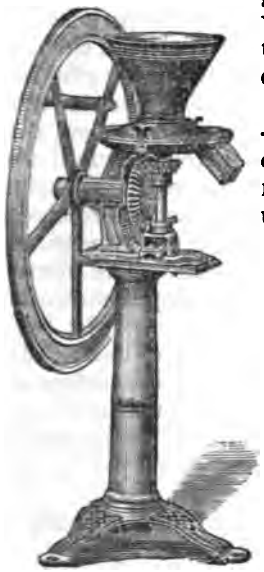
Swift's B Mill.—This is a comparatively new mill, very different in appearance from the old Swift's mill, and different in principle. The grinding-plates are horizontal, the lower one revolving, whilst the upper one is stationary and forms the lower part of the hopper. It has two fly-wheels, but the receptacle for the powder is an open one. A valuable feature of the Enterprise mill is present here,—*i.e.*, that of opening horizontally in the centre. The fineness of the powder is regulated by raising or lowering the lower plate by the thumb-screw.

3. Hand Drug-Mills having Conical Grinding Surfaces.—The principle of construction in these mills is probably the best, because it avoids the fault of those constructed on the vertical-plate principle, that of permitting particles to drop into the receptacle before they are finely ground, and also the fault of the horizontal-plate mills, which may hold the ground particles too long, often until clogging results. The conical-plate mill, if properly constructed, leaves little to be desired.

Hance's Mill is made on this principle. Formerly, the objection to this mill was the loss of time and labor consumed in getting it apart: this has been obviated by the introduction of the principle of opening it horizontally with the same kind of thumb-screw and hinge that is used in the Enterprise mill. The Hance mill is better adapted for heavy work than any other of the hand drug-mills, and, if desired, a belt and pulley can be attached for steam-power. The lower plate is conical in shape, the summit being elongated into a breaker; the teeth are arranged in consecutive rows, a scraper being attached to the under surface of the lower plate; the upper grinding surface is situated upon the lower surface of the hopper, and corresponds in shape and in the arrangement, number, and size of teeth with the surface of the lower plate. The revolving-plate is attached to the upright shaft by a simple key; this permits the easy removal of the plate when the mill is to be cleaned, yet holds it securely when in operation. Power is communicated by means of two shafts at right angles, geared with bevel cog-wheels. The fineness of the powder is regulated by a thumb-screw at the base, which elevates the revolving-plate. The support to the mill is a strong iron frame, which is cast in one piece, and, although the mill has but a single fly-wheel, this is partially compensated for by the length of the bearing for the horizontal shaft. Fig. 204 shows the

form which is mounted on a stand and is designed to be bolted to the floor; the new form, in which the mill is mounted on a box-stand, may be preferred by some. Fig. 205 shows the upper grinding-plate, and Fig. 206 the lower plate with a feeder, which is fastened to the upper portion with a set-screw, so that seeds and similar drugs may be automatically fed to the mill.

FIG. 204.



Hance's drug-mill.

General Rules for Operating Hand-Mills.—Much of the dissatisfaction experienced in operating hand-mills has arisen from improper methods of using them, or from failure to measure accurately the degree of resistance to disin-

FIG. 205.

Hance's mill (upper plate).

FIG. 206.

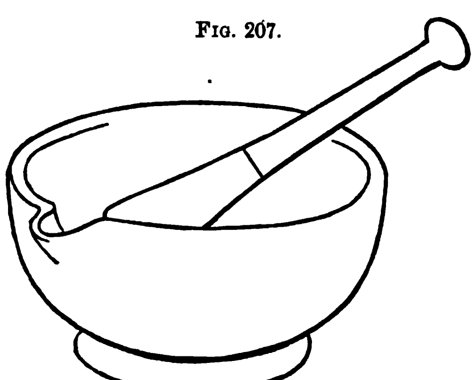
Hance's mill (lower plate).

tegration possessed by the substance to be ground. One of the first requisites, as before mentioned, is to dry the substance as perfectly as its physical character will permit without injuring it. If coarse, bulky, fibrous roots, barks, or similar substances are to be ground, they must first be cut or bruised. Most substances are ground with less labor if they are passed through the mill first with the coarse adjustment, returning the portion which is sifted out for regrinding, after setting the plates more closely together: this plan is repeated until the whole is ground. Care should be taken not to feed the substance into the hopper faster than it can be ground. The desire to get through quickly is the most frequent cause of clogging the mill, and when this occurs much time is lost, and the operator is strongly reminded of the well-worn proverb about undue haste. If a considerable quantity is to be ground, two persons can operate the mill more economically than one,—one feeding the mill carefully, the other supplying the physical labor, and, after the expiration of a given time, exchanging places. Good judgment is necessary in determining the rapidity with which substances can be fed into the hopper. Resinous or oily drugs, or substances which soften by heat, require very careful treatment and cannot be fed rapidly; dry ligneous barks or roots, on the other hand, can be fed as rapidly as the extent of grinding surface of the mill and the muscle of the operator will permit. The mill should be thoroughly cleaned after each operation, particular attention being given to the grinding-plates. In the case of substances which form hard lumps by heating or clogging upon the plates, the quickest way is to use boiling

water to soften or dissolve the lumps; the plates should then be quickly dried, to prevent rusting. By running sawdust or rice chaff through a mill, after an odorous drug has been ground, it may be speedily cleaned and freed from odor.

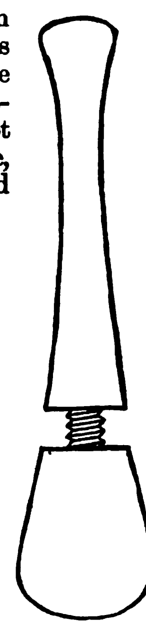
Trituration is the process of reducing substances to fine particles by rubbing them in a mortar with a pestle. The pestle is given a circular motion, accompanied by downward pressure, and the most effective method of using the pestle is to begin in the centre of the mortar and describe a circle of small diameter with the pestle on the substance, and gradually increase the size of the circle with each revolution until the side of the mortar is touched, when the motion is reversed and circles continually smaller in diameter are described until the centre is reached: this is repeated until pulverization is effected: by this treatment all the particles are brought under the action of the pestle. The mortar and pestle best adapted for this operation have the shapes shown in Fig. 207. Mortars with pestles having flattened ends are the best. Wedgwood-ware is very serviceable, but is difficult to keep clean. As triturating mortars are rarely subjected to blows, porcelain mortars of proper shape are preferred. One of the principal annoyances in the use of wedgwood or porcelain mortars and pestles is that of the continual loosening of the handle of the pestle. The cement employed by the manufacturer is chiefly rosin of bad quality, and in using the pestle the particles of loosened cement often drop into the mixture in the mortar during trituration. The best plan is to pull the handle out of the pestle entirely as soon as possible and reset it: this is easily done by heating the end of the pestle in a sand-bath until the cement has softened so that the handle may be extracted, then some hot cement (good sealing-wax) is poured into the pestle-hole, and the wooden handle is at once pressed forcibly in and

FIG. 207.



Mortar and pestle.

FIG. 208.

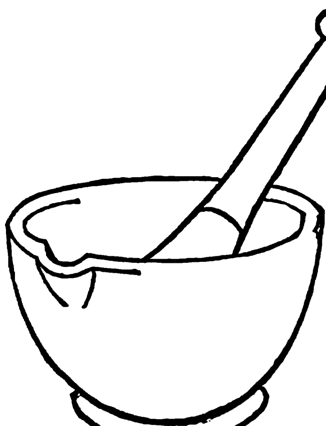


Pestle (hard-rubber handle).

held in its place by wedging or other means until the sealing-wax has hardened. The hard-rubber handle, which is made to screw accurately into the pestle (see Fig. 208), is a great improvement over the ordinary

handle, and the additional cost is more than repaid by the comfort of using it. Where trituration is combined with contusion, as frequently happens in effecting solutions of chemical substances, a wedgwood mortar of the shape shown in Fig. 209 is well suited for the purpose. The selection of good mortars and pestles is frequently overlooked amidst the many items of detail in furnishing a pharmacy; but few implements bring more satisfaction to the operator than good mortars and pestles. It is a safe rule to examine every purchase carefully before accepting it finally, to see whether the pestle fits the mortar accurately: it should have as much bearing on the interior surface of the mortar as its size will permit, because the rapidity of the trituration depends largely on the amount of contact of the surfaces.

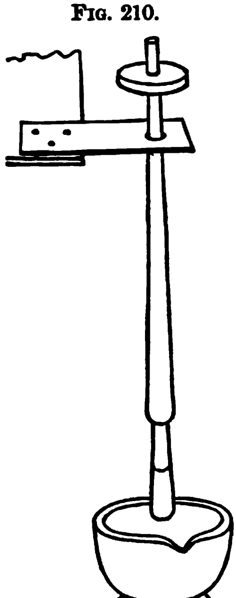
FIG. 209.



Wedgwood mortar and pestle.

The use of a round-surfaced pestle in a flat-surfaced mortar is just as great a waste of labor as that of a flat-surfaced pestle in a round-surfaced mortar. Trituration, as a distinct method of preparing a class of preparations, was officially recognized in the U.S. Pharmacopœia of 1880, and a new preparation, *Trituratio Elaterini*, made by triturating elaterin with sugar of milk, was introduced.

FIG. 210.



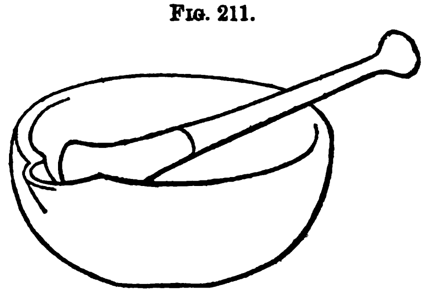
Triturating with loaded pestle.

Fig. 210 shows a device for facilitating trituration. It was communicated by Charles Rice, and is simpler and more effective than similar contrivances which have been described. It consists of an ordinary mortar and pestle, the latter having been lengthened by cutting down the mushroom top of the handle, so as to admit of its being inserted into the large end of a wooden handle, shaped somewhat like a ball-bat, and between two and three feet long. The upper end of this handle should be about an inch in diameter, and during the use of the pestle is to be kept upright and steady by passing through an opening in a piece of heavy pasteboard or wood which may be tacked to the under side of some convenient shelf. The mortar should stand on a counter about three feet from the floor, and the upper end of the pestle pass through a shelf above. To stop the noise caused by the pestle striking against the sides of the opening, a piece of sole-leather is attached to the under side of the shelf and the pestle passed through a hole in its centre. This also serves

another purpose; viz., when it is necessary to raise the pestle to admit of changing or stirring the contents of the mortar, the leather will clasp the enlargement of the handle so as to suspend the pestle securely out of the way of the hands. In using the apparatus, one hand grasps the handle just above its lower end, and a very slight effort is requisite to give it the necessary motion. The weight of the handle is usually sufficient to insure a proper degree of friction. If, however, more pressure is desired, the pestle can be weighted by slipping a perforated weight on to an iron pin driven in the top of the handle.

Mortars and pestles are sometimes made of green or white glass. The former are to be preferred because they are stronger; the latter, however, present a handsomer appearance. Glass mortars are not adapted to the continued trituration of hard substances. They are useful only in dissolving certain chemical substances directed in prescriptions, like corrosive sublimate, the alkaloids, etc. It is best to place the glass mortar over a dark surface, in order to show by contrast more clearly when the solution of the white object is effected.

FIG. 211.



Porcelain mortar and pestle.

Porcelain mortars and pestles (see Fig. 211) are, however, more generally useful as solution mortars. Pestles entirely of porcelain are objectionable, because they are so easily broken.

Spatulas.—The process of trituration as ordinarily performed requires the use of spatulas. These consist of flexible steel blades attached to handles, and in trituration they serve to loosen the substance as it becomes packed upon the sides of the mortar. Spatulas are largely used in extemporaneous pharmacy, and they will be alluded to frequently under various special heads in Part VII. The blade of a spatula is frequently broken when too much pressure is applied, but if the broken blade remaining in the handle have its sharp corners ground off upon a grindstone, or filed off, it will be just as useful for some purposes as it was when perfect.

Spatulas may now be had of excellent quality, and greatly improved in style over those formerly used. The best form is the balance-handled spatula (see Fig. 213). In this the metal of the handle and that of the

FIG. 212.

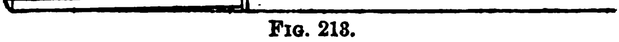


FIG. 213.

Balance-handled spatula.

blade are continuous and of the same width, so that the annoyance of the tang becoming loose in the handle, as in the old-style spatulas, is avoided. The flat metal handle is enlarged by riveting smooth, flat pieces of hard

wood to it to insure convenience in using. The balance-handle derives its name from the fact that when lying upon the counter the weight of the handle is sufficient to overcome the weight of the blade, so that contact of the blade with the counter is prevented. Solid-handled spatulas (see Fig. 214) are also made, the whole being of one solid piece

FIG. 214.

Solid-handled spatula.

of metal, and the handle being nickel-plated. A pocket spatula, which closes like a clasp-knife, is also furnished by dealers.

Fig. 215 shows a spatula coated with hard rubber, made by Fox,

FIG. 215.

Steel spatula blade, coated with hard rubber.

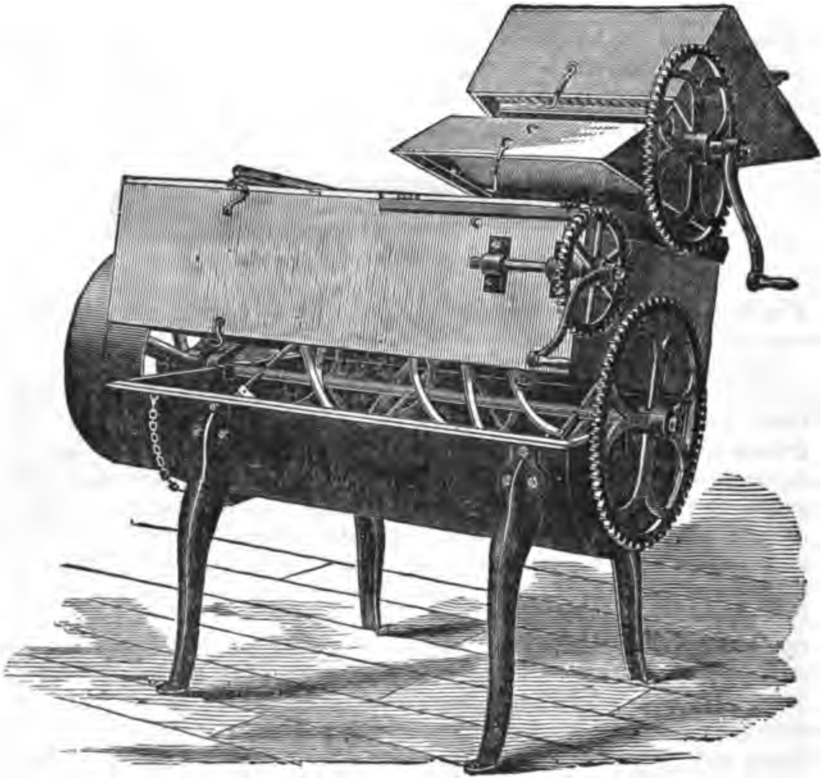
Foultz & Webster, for making ointments which contain corrosive substances, or substances acting on steel.

Sifting is the process of passing a powdered substance through the meshes of perforated material with the object of separating the coarser from the finer particles. Sieves are employed in this process: the frames are usually round, although sometimes they are oval, square, or rectangular. The ordinary sieve is usually made by stretching wire gauze over a flat wooden ring, and keeping it in its place by slipping over it a narrow wooden ring of slightly greater diameter, which is tacked securely. Covered sieves, or drum sieves, have tight covers for the top and bottom. The simplest pharmaceutical sieve for general use is obtained by making five rectangular frames, each four inches deep, ten inches wide, and sixteen inches long. These should be light but strong, and the bottoms covered with brass-wire gauze of different degrees of fineness. A box, ten inches deep, twelve inches wide, and twenty-two inches long, with a tight cover, is provided to hold the sieves and prevent dust from escaping. Two cleats are nailed horizontally upon the sides of the box, five inches from the top, for the sieve to slide upon, and a hole is cut in the front of the box in order to permit a handle, with a hook at the end, to pass through and be attached to a screw-eye in the front side of the sieve; two large corks are screwed to the back of the sieve at either end to act as buffers. The powdered substance is introduced into the proper sieve, which is placed upon the cleats, and the handle passed through the hole and hooked to the sieve; the cover is then placed in position, and the sieve pushed backward and forward, touching the back lightly.

A very important point, which must not be omitted after sifting substances, is the thorough mixing of all portions of the sifted powder, in order that each part of the finished powder may have a uniform composition. The starchy portions of a drug will be powdered more

quickly than the ligneous portions, and will usually pass through the sieve first: hence the sifted powder must always be thoroughly mixed. Upon the small scale this may be easily effected with a spatula or mortar and pestle; upon a larger scale special apparatus is needed. Hunter's sifter is one of the most effective: it is shown in Fig. 216. In this the powder is sifted in the cylindrical sieve, and adhering particles or small lumps are brushed through by the revolving

Fig. 216.



Hunter's sifter.

brushes; the revolving spiral mixers in the large box cause the particles to be thoroughly mingled. The illustration shows the method of operating so well that further description is unnecessary. In Fig. 217 is seen an enclosed sifter well adapted for many purposes, whilst Fig. 218 shows a sectional view of the same kind of sifter for smaller operations. The sieve is hemispherical in shape, and is contained in a tinned-iron scoop (see Fig. 219, which shows the end view). Two circles of stout wire are soldered to a central axis at right angles to each other, and the axis passes through the tin handle and terminates in a crank. When a powder is placed in the scoop, and the wire rings are made to revolve by turning the axis with the hand, the particles of powder are

rapidly forced through the meshes of the sieve. This apparatus is especially useful in breaking up moistened lumps in powders which are about to be percolated. (See Percolation.)

FIG. 217.

Sifter.

The degree of fineness of powders is designated in the United States Pharmacopœia by the number of meshes to the inch possessed by the sieve. The five different sizes are as follows:

Very fine powder should pass through a sieve having 80 or more meshes to the linear inch (30 meshes to the Cm.).

Fine powder should pass through a sieve having 60 meshes to the linear inch (24 meshes to the Cm.).

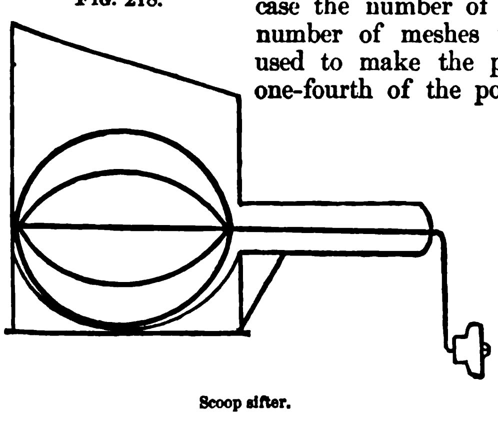
Moderately fine powder should pass through a sieve having 50 meshes to the linear inch (20 meshes to the Cm.).

Moderately coarse powder should pass through a sieve having 40 meshes to the linear inch (16 meshes to the Cm.).

Coarse powder should pass through a sieve having 20 meshes to the linear inch (8 meshes to the Cm.).

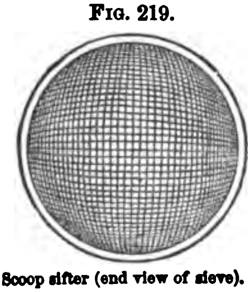
In special cases powders of different degrees of fineness (*e.g.*, No. 30, No. 12) are directed to be taken. In every case the number of the powder indicates the number of meshes to the inch of the sieve used to make the powder. Not more than one-fourth of the powder is expected to pass through a sieve having ten more meshes to the inch than the one designated.

FIG. 218.



Scoop sifter.

FIG. 219.

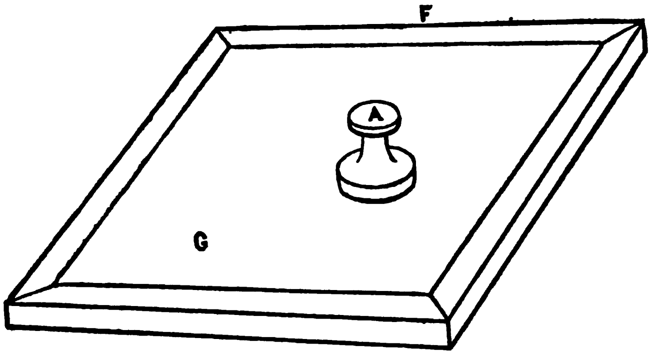


Scoop sifter (end view of sieve).

For very fine powders, bolting-cloth is used for the sifting medium; and when acid substances are to be sifted, horse-hair sieves are used.

Levigation is the process of reducing substances to a state of minute division by triturating them after they have been made into a paste with

FIG. 220.

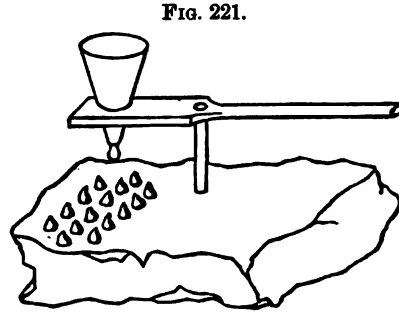


Slab and muller.

water or other liquid. This is effected in a shallow mortar with a flat-surfaced pestle, or upon a ground-glass slab with a flat-surfaced glass muller (see Fig. 220). The motion imparted to the muller, A, closely resembles the figure 8; this is frequently varied with that of elongated circles which intersect each other, the object being to vary the motion so that all particles of the powder may be brought under the action of the muller upon the slab G. Certain substances, like red mercuric oxide and zinc oxide, if made into a paste with alcohol or water, are more readily reduced to fine powder in this way than by the action of the mortar and pestle. The process is termed *porphyrization* when performed with a porphyry slab and muller.

Elutriation is the process of obtaining a substance in fine powder by suspending an insoluble powder in water, allowing the heavier particles to fall to the bottom of the vessel, and decanting the liquid containing the lighter particles into another vessel, and there collecting them. It is *water-sifting* practically, wherein the superior gravity of the larger particles is used as a means of separating them from the smaller. Prepared chalk is a familiar illustration of an elutriated powder.

FIG. 221.



Trochiscator.

Trochiscation is the process of making the pasty mass or magma obtained by elutriation into dry, conical masses. This is usually accomplished by the use of the little apparatus shown in Fig. 221. This consists of a tinned-iron cone, supported in a circular wooden frame which has one short wooden leg and a handle. A slab of chalk or other porous sub-

stance is provided, and after filling the cone with the pasty mass the handle is taken in the right hand and the leg of the frame is tapped gently upon the slab of chalk: the shock causes a conical mass of the substance to fall upon it, whereupon the moisture present soon becomes absorbed, so that the little cone dries quickly. A succession of taps, with a slight lateral movement, deposits the cones in regular rows, and when the slab is full the first cones are found to be dry enough to be transferred, and all will soon be in the same condition. Chalk, bismuth, lake, and other insoluble powders are formed into conical nodules in this way.

Pulverization by Intervention is the process of reducing substances to powder through the use of a foreign substance, from which the powder is subsequently freed by some simple method. No general process can be given for this method of pulverization, as the character of the substance must determine the method. The metal gold may be powdered by rubbing gold-leaf in a mortar in contact with potassium sulphate: the latter is subsequently dissolved out with water. Camphor may be pulverized through the addition of a few drops of alcohol, chloroform, or other solvent. The foreign substance in this case is disposed of through evaporation. Metallic tin may be granulated by melting it and agitating it in a box containing powdered chalk: the latter is subsequently dissolved out with diluted acetic acid. Phosphorus may be pulverized by placing it in water contained in a small flask, then heating the water gradually until the phosphorus is melted, and shaking the flask while the phosphorus is cooling: the agitation in the presence of water keeps the particles from cohering.

QUESTIONS ON CHAPTERS VII. AND VIII.

DESICCATION AND COMMINUTION.

What is desiccation?
What are the objects of desiccation?
How may roots, herbs, and leaves be conveniently dried on the large scale?
What is meant by "gruffs?"
What use is made of "gruffs?"
Why does the U. S. P. direct myrrh in substance and not in powder in making compound iron mixture?
Table showing loss in powdering medicinal substances.
What is comminution?
What are the objects of comminution?
How may roots, barks, etc., be conveniently cut?
How upon the large scale?
How may drugs be most conveniently bruised or contused?
When it becomes necessary to use an iron mortar and pestle for a considerable length of time, how may the labor of lifting the pestle be lessened?
For what purposes are wooden mortars used?
For what purposes are marble mortars used?
In using marble mortars, what precautions are necessary?
What is the difference between grinding and pulverizing?
What drugs are most injured by drying?

What is a buhr-stone mill?
What two varieties are there, and what are they called?
What is the peculiarity of each?
What are roller-mills?
What are the rollers usually made of?
What is the form of the rollers?
What are chaser-mills?
How are the stones arranged?
How are powders of greater or less degrees of fineness obtained from chaser-mills?
What are barrel-mills?
How is the "Bogardus" mill constituted, and what is its peculiarity?
What is Mead's disintegrator?
What is requisite in running this mill?
What three classes of hand-mills are there?
Describe Swift's mill (old style).
What improvements have been made in the new-style Swift's mill?
Describe Troemner's mill.
Describe the Enterprise mill.
What are its advantages?
Describe Thomas's mill.
What are the principal objections to this mill?
Describe Swift's B mill.
Describe Hance's mill.
Is Hance's mill best adapted for light or heavy work?
What are the most usual difficulties met with in operating hand-mills?
How may these be obviated?
What is a good method of cleaning a mill after an odorous drug has been ground?
What is trituration?
What shaped mortars and pestles are best adapted to the purpose of trituration?
What objection is there to the ordinary pestle of porcelain or wedgwood mortars?
How is this best remedied?
Is the hard-rubber handle any better, and if so, why?
What preparation, called a "trituration," has been made official in the U. S. P.?
Describe a device for facilitating trituration.
What is the objection to glass mortars and pestles?
Which are most useful,—mortars and pestles of porcelain, white glass, or green glass, and why?
What is a spatula, and what is its best form?
For what are spatulas covered with hard rubber useful?
How is the process of sifting accomplished?
How are the degrees of fineness of powders designated in the U. S. P.?
How many degrees of fineness are so designated?
What is meant by a very fine powder? Fine powder? Moderately fine powder? Moderately coarse powder? Coarse powder?
In some special cases other degrees of fineness than these five are designated, as, for example, No. 30 and No. 12: what is meant by these numbers?
What is levigation?
What is meant by porphyrization? By elutriation?
Give an example of an elutriated powder.
What is trochiscation?
What is pulverization by intervention?
Give an example of this process.

CHAPTER IX.

SOLUTION.

Solution.—In pharmacy this term is applied to the process whereby any substance is liquefied or made to disappear when brought in contact with a liquid: the particles of the substance being uniformly diffused through the liquid, no separation takes place upon standing. The liquid used to effect this change is called a *solvent*, and, after its combination with the dissolved substance, a *solution;* if the liquid has exercised its powers as a solvent to its utmost extent, and is incapable of retaining any more of the dissolved substance, it is termed a *saturated solution*. A substance which is not acted on by a solvent is said to be *insoluble*.

Solution of Solids.—This is an operation which is very frequently performed by the pharmacist: in this place only the methods of effecting the solution of solid bodies which can be entirely dissolved in the solvent will be noticed. This excludes the operations of Infusion, Decoction, Percolation, Maceration, etc., which will be considered at length in subsequent chapters. Solution may be of two kinds: 1, Simple; 2, Chemical.

1. **Simple Solution** is where the solid suffers no alteration on being dissolved, except that which depends upon its external form, and where, if the reverse operation of evaporation is applied, the solid substance is recovered unchanged. The making of simple syrup is an example.

2. **Chemical Solution** is where the properties of the dissolved body are changed by the chemical action of the solvent or some of the substances added, and the simple process of evaporation results in the production of a body having different properties, as, for example, in the official solution of mercuric nitrate.

Effects of Pulverization and Agitation.—The solution of solids may be facilitated by pulverizing them and stirring the mixture, thus increasing their extent of surface and promoting the frequent contact of the surfaces with fresh portions of the solvent. This is easily illustrated, as already noted under Comminution, by placing half an ounce of lump alum and half an ounce of powdered alum each in a pint of water at the same time: a few vigorous stirs will soon cause the latter to dissolve, whilst the former will require a much longer time.

Effect of Heat.—The application of heat generally favors solubility, for nearly all substances are more soluble in hot liquids than in cold ones. In addition to this, the convection currents in the liquid caused by heat hasten the solution by constantly bringing fresh surfaces into

contact with the liquid. In many cases the ratio of solubility is not the same for equal increments of heat.

Density of Solutions.—The effect of dissolving a solid body, specifically heavier than the solvent, is always to increase the density of the liquid in which the solid is dissolved. The specific gravity of water is 1.000: if five per cent. of sugar is dissolved in it, the specific gravity is 1.021; if ten per cent., 1.070; if twenty per cent., 1.088, etc. This fact is capable of optical proof; for if a piece of sugar is suspended near the top of some water in a beaker, the downward currents of the solution can readily be noticed if viewed by transmitted light.

Solubility of Substances in Saturated Solutions.—Whilst a saturated solution is one which is incapable of dissolving any more of the substance which was dissolved in the liquid, it must not be assumed that the saturated solution will not dissolve *other* solids. For example, if granulated potassium nitrate be mixed with two per cent. of copper sulphate, and then placed in a funnel having a plug of cotton in the throat, it will be found that the copper sulphate can be very easily removed by pouring on the potassium nitrate mixture a *saturated solution* of potassium nitrate. The potassium nitrate cannot suffer loss, because the liquid passing through is a saturated solution of the same substance; but copper sulphate is soluble in a saturated solution of potassium nitrate, and it is thus washed out.

Reduction in Temperature caused by Rapid Solution.—When solids dissolve rapidly in liquids without chemical action, a reduction in temperature always takes place, and cold is produced, in accordance with the well-known law governing the conversion of solids into liquids, whereby sensible heat is converted into latent heat. The so-called freezing mixtures are produced in this way: thus, if five parts of potassium sulphocyanide are quickly mixed with four parts of cold water, the temperature of the solution falls to —20° C. (—4° F.); thirty-two parts of sodium chloride, if mixed with one hundred parts of snow, will produce a brine having a freezing-point of —23° C. (—9.4° F.). Equal parts of crystallized calcium chloride and snow, when well mixed, will have a temperature as low as —45° C. (—49° F.).

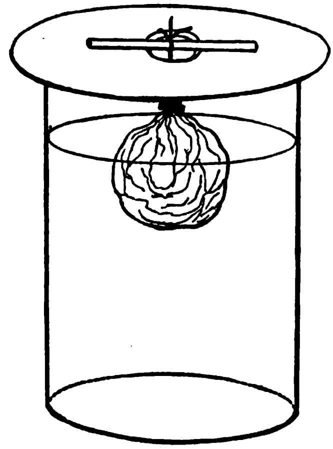
Elevation of Temperature produced by Solution accompanied by Chemical Action.—If chemical action takes place whilst solution is progressing, the opposite effect, or elevation of temperature, is frequently produced, as in dissolving anhydrous salts. The same fact is noticed when the solution of an alkaline oxide made by calcination is effected by treating it with an acid, as when calcined magnesia is dissolved in a solution of citric acid.

Modes of Effecting Solutions of Solids.—The method usually employed by the pharmacist is by the use of the solution mortar and pestle (see page 190). The ordinary practice is to crush the substance into fragments in the mortar with the pestle, and then pour upon it the solvent, meanwhile stirring with the pestle until solution is effected. If definite quantities are used, and the whole of the solvent is required to dissolve the given weight of the salt, a portion only of the solvent should be added at first, and when this is saturated the solution is poured off, and a fresh portion of solvent added: this operation is

repeated until the solid is entirely dissolved; the solutions are then mixed. Other methods of effecting solution are to shake the solid with the liquid in a bottle or flask, or to apply heat to the substances in a suitable vessel.

Circulatory Solution.—A very excellent mode of dissolving substances, particularly where the solid is not very soluble or the relative proportion of liquid is small, is to suspend the solid near the top of the liquid upon a porous diaphragm or a suitable sieve, or tied up in a gauze bag if its nature will admit of this treatment. The parts immediately in contact with the solvent are dissolved, and the solution descends, its place being supplied by fresh portions of the solvent: a circulation is thus created and solution facilitated (see Fig. 222).

FIG. 222.



Circulatory solution.

Solvents used in Pharmacy.—*Water.*—The most useful of all solvents is water. It has a more extensive range than any other liquid, and the aqueous solutions are among the most important preparations of pharmacy. They are especially treated of in chapters, under the head of Liquores, Aquæ, Syrupi, etc.

Alcohol as a solvent is next in importance to water. It has an important advantage over water in the fact that preparations made with it keep almost indefinitely, whilst most aqueous solutions of organic substances soon decompose or become worthless. Resins, volatile oils, alkaloids, glucosides, salts, etc., are dissolved by alcohol, whilst many inert principles, like gum, albumen, and starch, are insoluble in it, so that it has also great usefulness in its negative character.

Glycerin is an excellent solvent, although its range is not so extensive as either of the preceding: it has in its concentrated state antiseptic qualities of a high order, but has not the valuable negative qualities of alcohol. It dissolves the fixed alkalies, some of the alkaline earths, a large number of neutral salts, and vegetable acids, pepsin, tannin, etc., but it also dissolves gum, albumen, starch, etc., and thus its solutions are generally loaded with inert constituents. (See Glycerites.)

Æther is a good solvent for special purposes. Oils, fats, resins, and some of the alkaloids and neutral principles are dissolved by it.

Benzin is very similar in its solvent properties to ether.

Chloroform resembles ether and benzin as a solvent. It has an advantage over both, however, in not being inflammable, although its costliness prevents any extended application.

Carbon Disulphide is an excellent solvent for rubber, phosphorus, etc. Its range is limited, however, and its odor and inflammability detract from its usefulness.

Acids, either strong or diluted, are used as solvents; as in vinegars.

Oils are also used in this way in liniments, etc.

Table of the Solubility of Official Chemicals in Water and in Alcohol.

Abbreviations: s = soluble; ins. = insoluble; sp. = sparingly; v. = very; alm. = almost; dec. = decomposed.

Chemicals. One part is soluble	In Water. At 15° C. (59° F.). Parts.	In Water. Boiling. Parts.	In Alcohol. At 15° C. (59° F.). Parts.	In Alcohol. Boiling. Parts.
Acidum Arsenosum	30–80	15	sp.	sp.
" Benzoicum	500	15	2	1
" Boricum	25.6	—	15	—
" Carbolicum	15	—	v. s.	v. s.
" Chromicum	v. s.	v. s.	dec.	dec.
" Citricum	0.63	0.4	1.61	1.43
" Gallicum	100	3	5	1
" Salicylicum	450	14	2.4	v. s.
" Stearicum	ins.	ins.	45	v. s.
" Tannicum	1	v. s.	0.6	v. s.
" Tartaricum	0.8	0.5	2.5	0.2
Adeps	ins.	ins.	v. sp.	—
Alumen	9	0.3	ins.	ins.
" Exsiccatum	20	0.7	ins.	ins.
Alumini Hydras	ins.	ins.	ins.	ins.
" Sulphas	1.2	v. s.	ins.	ins.
Ammonii Benzoas	5	1.2	28	7.6
" Bromidum	1.5	0.7	30	15
" Carbonas	5	dec.	dec.	dec.
" Chloridum	3	1	alm. ins.	alm. ins.
" Iodidum	1	0.5	9	3.7
" Nitras	0.5	v. s.	20	3
" Valerianas	v. s.	v. s.	v. s.	v. s.
Antimonii et Potassii Tartras	17	3	ins.	ins.
" Oxidum	alm. ins.	alm. ins.	ins.	ins.
" Sulphidum	ins.	ins.	ins.	ins.
" Sulphidum Purificatum	ins.	ins.	ins.	ins.
Antimonium Sulphuratum	ins.	ins.	ins.	ins.
Apomorphinæ Hydrochloras	45	dec.	45	dec.
Argenti Cyanidum	ins.	ins.	ins.	ins.
" Iodidum	ins.	ins.	ins.	ins.
" Nitras	0.6	0.1	26	5
" " Fusus	0.6	0 5	26	5
" Oxidum	v. sp.	v. sp.	ins.	ins.
Arseni Iodidum	7	dec.	30	dec.
Atropina	130	35	3	v. s.
Atropinæ Sulphas	0.4	v. s.	6.2	v. s.
Benzinum	ins.	—	6	—
Bismuthi Citras	ins.	ins.	ins.	ins.
" et Ammonii Citras	v. s.	v. s.	sp.	sp.
" Subcarbonas	ins.	ins.	ins.	ins.
" Subnitras	alm. ins.	alm. ins.	ins.	ins.
Bromum	30	—	dec.	dec.
Caffeina	80	9.5	33	v. s.
Calcii Bromidum	0.7	v. s.	1	v. s.
" Carbonas Præcipitatus	ins.	ins.	ins.	ins.
" Chloridum	1.5	v. s.	8	1.5
" Hypophosphis	6.8	6	ins.	ins.
" Phosphas Præcipitatus	ins.	dec.	ins.	ins.
" Sulphas Exsiccatus	410	476	ins.	ins.
Calx	750	1300	ins.	ins.
Camphora Monobromata	alm. ins.	alm. ins.	v. s.	v. s.
Cerii Oxalas	ins.	ins.	ins.	ins.

Solubility of Official Chemicals in Water and in Alcohol.—(*Continued.*)

Chemicals. One part is soluble	In Water. At 15° C. (59° F.). Parts.	In Water. Boiling. Parts.	In Alcohol. At 15° C. (59° F.). Parts.	In Alcohol. Boiling. Parts.
Chloral	v. s.	v. s.	v. s.	v. s.
Chrysarobinum	alm. ins.	alm. ins.	sp.	150
Cinchonidinæ Sulphas	70	1.42	66	8
Cinchonina	3760	3500	116	26.5
Cinchoninæ Sulphas	66	13.59	10	3.25
Cocainæ Hydrochloras	0.48	v. s.	3.5	v. s.
Codeina	80	17	3	v. s.
Creta Præparata	alm. ins.	alm. ins.	ins.	ins.
Cupri Sulphas	2.6	0.5	alm. ins.	alm. ins.
Elaterinum	4250	1820	337	34
Ferri Chloridum	v. s.	v. s.	v. s.	v. s.
" Citras	s.	v. s.	ins.	ins.
" et Ammonii Citras	v. s.	v. s.	ins.	ins.
" " " Sulphas	3	0.8	ins.	ins.
" " " Tartras	v. s.	v. s.	ins.	ins.
" " Potassii Tartras	v. s.	v. s.	ins.	ins.
" " Quininæ Citras	s.	v. s.	ins.	ins.
" " " " Solubilis	s.	—	sp.	—
" " Strychninæ Citras	v. s.	v. s.	sp.	sp.
" Hypophosphis	sp.	sp.	ins.	ins.
" Lactas	40	12	alm. ins.	alm. ins.
" Oxidum Hydratum	ins.	ins.	ins.	ins.
" Phosphas Solubilis	v. s.	v. s.	ins.	ins.
" Pyrophosphas Solubilis	v. s.	v. s.	ins.	ins.
" Sulphas	1.8	0.3	ins.	ins.
" " Granulatus	1.8	0.3	ins.	ins.
" Valerianas	ins.	dec.	v. s.	v. s.
Hydrargyri Chloridum Corrosivum	16	2	3	1.2
" " Mite	ins.	ins.	ins.	ins.
" Cyanidum	12.8	3	15	6
" Iodidum Flavum	alm. ins.	alm. ins.	ins.	ins.
" " Rubrum	alm. ins.	alm. ins.	130	15
" Oxidum Flavum	alm. ins.	alm. ins.	ins.	ins.
" " Rubrum	alm. ins.	alm. ins.	ins.	ins.
" Subsulphas Flavus	2000	600	ins.	ins.
Hydrargyrum Ammoniatum	alm. ins.	alm. ins.	alm. ins.	alm. ins.
Hydrastininæ Hydrochloras	0.3	—	3	—
Hyoscinæ Hydrobromas	1.9	—	13	—
Hyoscyaminæ Hydrobromas	0.3	—	2	—
" Sulphas	0.5	—	25	—
Iodoformum	sp.	ins.	52	12
Iodum	5000	—	10	—
Lithii Benzoas	4	2.5	12	10
" Bromidum	0.6	0.3	v. s.	v. s.
" Carbonas	80	140	ins.	ins.
" Citras	2	0.5	sp.	sp.
" Salicylas	v. s.	v. s.	v. s.	v. s.
Magnesia	alm. ins.	alm. ins.	ins.	ins.
" Ponderosa	alm. ins.	alm. ins.	ins.	ins.
Magnesii Carbonas	alm. ins.	alm. ins.	ins.	ins.
" Sulphas	1.5	0.7	ins.	ins.
Mangani Dioxidum	ins.	ins.	ins.	ins.
" Sulphas	0.8	1	ins.	ins.
Menthol	sp.	—	v. s.	—
Methyl Salicylas	—	—	v. s.	—
Morphina	4350	455	300	36
Morphinæ Acetas	2.5	1.5	47.6	14
" Hydrochloras	24	0.5	62	31
" Sulphas	21	0.75	702	144

Solubility of Official Chemicals in Water and in Alcohol.—(*Continued.*)

Chemicals. One part is soluble	In Water. At 15° C. (59° F.). Parts.	In Water. Boiling. Parts.	In Alcohol. At 15° C. (59° F.). Parts.	In Alcohol. Boiling. Parts.
Naphtalinum	ins.	—	15	v. s.
Naphtol	1000	75	0.75	v. s.
Phosphorus	ins.	ins.	350	240
Physostigminæ Salicylas	150	30	12	v. s.
" Sulphas	v. s.	v. s.	v. s.	v. s.
Picrotoxinum	240	25	9	3
Pilocarpinæ Hydrochloras	v. s.	v. s.	v. s.	v. s.
Piperinum	alm. ins.	alm. ins.	30	1
Plumbi Acetas	2.3	0.5	21	1
" Carbonas	ins.	ins.	ins.	ins.
" Iodidum	2000	200	v. sp.	v. sp.
" Nitras	2	0.75	alm. ins.	alm. ins.
" Oxidum	alm. ins.	alm. ins.	ins.	ins.
Potassa	0.5	v. s.	2	v. s.
Potassii Acetas	0.36	v. s.	1.9	v. s.
" Bicarbonas	3.2	dec.	alm. ins.	alm. ins.
" Bichromas	10	1.5	ins.	ins.
" Bitartras	201	16.7	v. sp.	v. sp.
" Bromidum	1.6	1	200	16
" Carbonas	1.1	0.65	ins.	ins.
" Chloras	16.7	1.7	ins.	ins.
" Citras	0.6	v. s.	sp.	sp.
" Cyanidum	2	1	sp.	sp.
" et Sodii Tartras	1.4	1	alm. ins.	alm. ins.
" Ferrocyanidum	4	2	ins.	ins.
" Hypophosphis	0 6	0.3	7.3	3.6
" Iodidum	0.75	0 5	18	6
" Nitras	3.8	0.4	alm. ins.	alm. ins.
" Permanganas	16	3	dec.	dec.
" Sulphas	9.5	4	ins.	ins.
Pyrogallol	1.7	v. s.	1	v. s.
Quinidinæ Sulphas	100	7	8	v. s.
Quinina	1670	760	6	2
Quininæ Bisulphas	10	v. s.	32	v. s.
" Hydrobromas	54	v. s.	0.6	v. s.
" Hydrochloras	34	1	3	v. s.
" Sulphas	740	30	65	3
" Valerianas	100	40	5	1
Resorcinum	0.6	v. s.	0.5	v. s.
Saccharum	0.5	0 2	175	28
" Lactis	6	1	ins.	ins.
Salicinum	28	0.7	30	2
Salol	alm. ins.	—	10	v. s.
Santoninum	alm. ins.	250	40	3
Soda	1.7	0.8	v. s.	v. s.
Sodii Acetas	1.4	0.5	30	2
" Arsenas	4	v. s.	v. sp.	60
" Benzoas	1.8	1.3	45	20
" Bicarbonas	11 8	dec.	ins.	ins.
" Bisulphis	4	2	72	49
" Boras	16	0.5	ins.	ins.
" Bromidum	1.2	0.5	13	11
" Carbonas	1.6	0.2	ins.	ins.
" Chloras	1.1	0 5	100	40
" Chloridum	2.8	2.5	alm. ins.	alm. ins.
" Hypophosphis	1	0.12	30	1
" Hyposulphis	0.65	dec.	ins.	ins.
" Iodidum	0.6	0.33	3	1.4
" Nitras	1.3	0.6	100	40

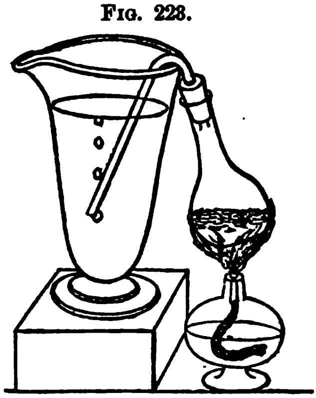
Solubility of Official Chemicals in Water and in Alcohol.—(*Continued.*)

Chemicals. One part is soluble	In Water. At 15° C. (59° F.).	In Water. Boiling.	In Alcohol. At 15° C. (59° F.).	In Alcohol. Boiling.
	Parts.	*Parts.*	*Parts.*	*Parts.*
Sodii Nitris	1.5	v. s.	sp.	sp.
" Phosphas	5.8	1.5	ins.	ins.
" Pyrophosphas	12	1.1	ins.	ins.
" Salicylas	0.9	v. s.	6	v. s.
" Sulphas	2.8	0.4	ins.	ins.
" Sulphis	4	0.9	sp.	sp.
" Sulphocarbolas	4 8	0.7	132	10
Sparteinæ Sulphas	v. s.	v. s.	v. s.	v. s.
Strontii Bromidum	1.05	0.5	v. s.	v. s.
" Iodidum	0.6	0.27	s.	s.
" Lactas	4	0.5	s.	s.
Strychnina	6700	2500	110	12
Strychninæ Sulphas	50	2	109	8.5
Sulphur Lotum	ins.	ins.	sp.	sp.
" Præcipitatum	ins.	ins.	sp.	sp.
" Sublimatum	ins.	ins.	sp.	sp.
Sulphuris Iodidum	alm. ins.	dec.	dec.	dec.
Terebenum	sp.	sp.	s.	s.
Terpini Hydras	250	32	10	2
Thymol	1200	—	1	v. s.
Veratrina	v. sp.	v. sp.	3	v. s.
Zinci Acetas	2.7	1.5	36	3
" Bromidum	v. s.	v. s.	v. s.	v. s.
" Carbonas Præcipitatus	ins.	ins.	ins.	ins.
" Chloridum	0.3	v. s.	v. s.	v. s.
" Iodidum	v. s.	v. s.	v. s.	v. s.
" Oxidum	ins.	ins.	ins.	ins.
" Phosphidum	ins.	ins.	ins.	ins.
" Sulphas	0.6	0.2	ins.	ins.
" Valerianas	100	—	40	—

SOLUTION OF GASES IN LIQUIDS.

The methods employed to effect the solution of gases in liquids differ essentially from ordinary processes of solution, and depend upon the solubility of the gas in the liquid, the relative specific gravity, and the strength of the solution desired. It is usually sufficient to conduct the gas into the liquid by a suitable tube, reaching nearly to the bottom, when more or less of the gas is absorbed by the liquid. Fig. 223 shows a simple method where the gas is readily soluble in the liquid, as in making chlorine water. For a continuous operation, as in making hydrochloric, nitric, and hydrobromic acids, and similar liquids, the well-known Woulffe's, or three-necked, bottles are employed advantageously, the gas which escapes solution in one bottle passing over into the next. The washing-bottle shown in Fig. 224 is easily made, and well adapted for purifying the gas after it is

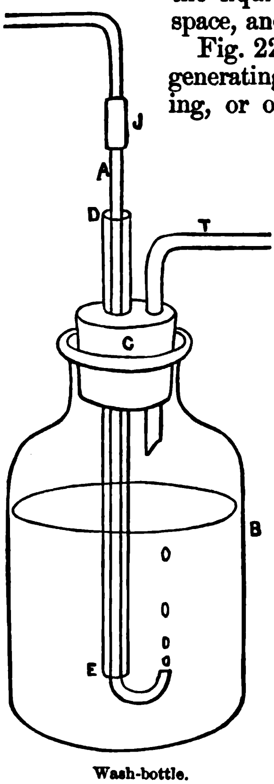
FIG. 223.



Method of absorbing gas.

generated. B is an ordinary wide-mouthed bottle, closed with a perforated rubber cork, C; a wide tube, D E, passes nearly to the bottom, and a narrow tube, A, is joined by a short piece of rubber tubing, J, to the tube leading from the generating flask, and at the other extremity is curved upward so as properly to deliver the gas into the water placed in the bottle to wash it: it escapes by the bent tube, T, which is continued until it dips into the liquid in which the gas is to be dissolved. The space between the tube A and the wide tube D E acts as a safety-valve: if the pressure accumulates through the too rapid generation of the gas, or if a stoppage occurs in the delivery-tube, the liquid in the bottle is first blown out through this space, and the pressure is thus relieved.

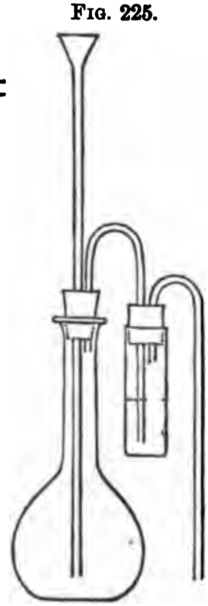
FIG. 224.



Wash-bottle.

Fig. 225 shows a very convenient little apparatus for generating and washing small quantities of gases, for testing, or other purposes: the wash-bottle is made from a homœopathic vial, rubber corks being used, and the bent tubes by bending ordinary glass tubing over a flame as described on page 143. The funnel-tube permits the addition of fresh liquid to hasten or continue the action as the operation progresses. It is usual to add merely sufficient water to cover the orifice of the delivery-tube in the wash-liquid at the beginning of an operation, as the aqueous vapor carried over by the gas condenses in the wash-bottle, which soon increases in quantity, and may accumulate in a long operation to an extent which will necessitate a partial discharge of its contents or the entire cessation of the process. As the apparatus suitable for each operation must be especially selected, general observations on the solution of gases will not be so useful in this chapter as a detailed process in connection with each preparation where it is described in the subsequent pages. One general rule should be noted, however,—*i.e.*, that gases are generally more rapidly and thoroughly absorbed by cold liquids than by hot ones: hence the receiving bottle should be kept surrounded by ice or otherwise refrigerated.

FIG. 225.



Gas-generator.

QUESTIONS ON CHAPTER IX.

SOLUTION.

What is meant by solution?
What is the liquid used to make a solution called?
What is a saturated solution?
When is a substance said to be insoluble?
What two kinds of solution are there?
Give examples of each.
How may the solution of solids be facilitated?
What is the effect of dissolving a solid body specifically heavier than the solvent?
How may this be shown?
Is a saturated solution of one substance capable of dissolving some other substance?
Give an example.
When solids dissolve rapidly in liquids without chemical action, what takes place?
How are freezing mixtures made?
What is the effect if during the solution chemical action takes place?
How are solutions usually made by the pharmacist?
What is meant by circulatory solution?
Name the principal solvents used in pharmacy.
What are some of the advantages of alcohol as a solvent of glycerin?
For what substances is ether a good solvent?
What advantages has ether over chloroform?
What are objections to carbon disulphide as a solvent?
Upon what do the methods for making solutions of gases in liquids depend?
Where a gas is freely soluble in a liquid, how is a solution usually effected?
What is the arrangement of a Woulffe's bottle?
Are gases generally more rapidly and thoroughly dissolved by cold or hot liquids?

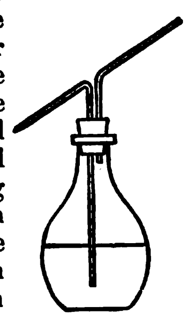
CHAPTER X.

SEPARATION OF FLUIDS FROM SOLIDS.

THE operations involved under this head are among those which are most frequently used in pharmacy,—*i.e.*, Lotion, Decantation, Colation, Filtration, Clarification, Expression, Percolation, etc.,—and the principles which govern the successful performance of these practical processes should be mastered early in the career of the student. They are almost exclusively mechanical processes.

Lotion, or Displacement Washing, is the process of separating soluble matter from a solid by pouring a liquid upon it which will dissolve and wash out the soluble portion. The separation of the fluid from the solid is generally effected by placing an obstruction in a funnel or cylindrical vessel, such as a plug of cotton or tow, notched cork, filter-paper, etc., and then, having introduced the solid into the funnel and arranged a suitable vessel beneath, the liquid is poured upon it. (See Percolation.) Precipitates are frequently purified from contaminating soluble matter in this way. A very convenient method of applying the liquid is by the use of the spritz bottle (see Fig. 226). This is usually made from a flask, but a round-shouldered pint bottle of the diameter most easily grasped by the hand is preferable. Two glass tubes, one bent at an acute angle and the other at an obtuse angle, are used; one end of the former is drawn out to a capillary orifice, and the other extends nearly to the bottom of the bottle. The obtuse-angled tube merely enters the bottle below the cork; the upper portion of this tube should be held in the gas-flame, so as to fuse the edges of the glass and thus prevent cutting the lips when it is used. By filling the bottle with liquid, and blowing with the mouth through the tube, a stream of liquid is ejected from the capillary orifice which can be directed to any portion of a solid substance that is to be washed. It is often desirable, in order to save time, to use the liquid hot. One of the wicker-covered bottles in which Farina cologne is imported answers a good purpose here to prevent burning the fingers, and if care is used to pour in a small quantity of hot liquid first and agitate it before adding the rest, so that the glass may be *gradually* warmed, there is no danger of fracturing the bottle.

FIG. 226.

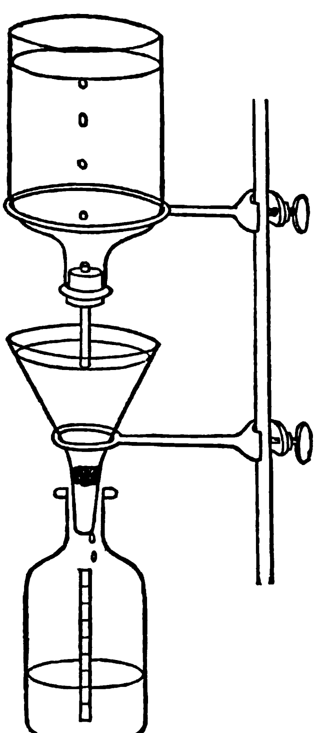


Spritz bottle.

Continuous Washing.—The use of the spritz bottle for small operations is convenient. A simple method of automatically supplying the wash-liquid in larger quantities is shown in Fig. 228. This requires

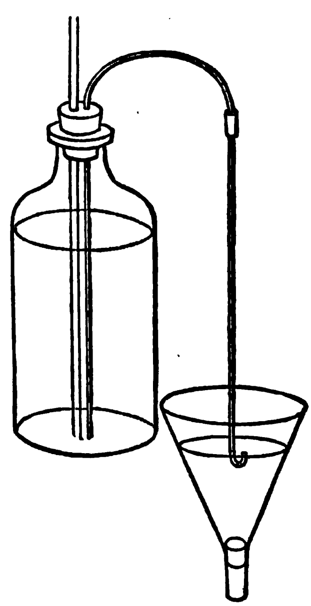
no attention from the operator except at the beginning of the operation. The bottle is furnished with a perforated cork and a short glass tube. All that is necessary is to fill the bottle and adjust it over the funnel so that the end of the tube shall be at the height desired for the liquid: on tilting the bottle slightly (if the tube selected is not too narrow in diameter) the liquid will run out into the funnel until it rises to the orifice of the tube, when the flow will cease. As the liquid gradually passes through the solid substance in the funnel, the level falls, and bubbles of air pass through the tube into the bottle, the liquid once more flows, and the operation continues until the bottle is empty. Many elaborate methods of continuous washing have been suggested, and many have been practically tried by the author, but if care is taken in the simple apparatus just described to have the tube of proper diameter, at least so wide that the force of capillary attraction shall not be strong enough to prevent the ingress of air, it is the most satisfactory of all. Bottles having narrow mouths may often be used in the same way, and the cork and tube be dispensed with. A little practice will enable the operator to make a bottle in which the parts are adjusted to a nicety. On the large scale, Prof.

FIG. 228.



Continuous washing.

FIG. 229.



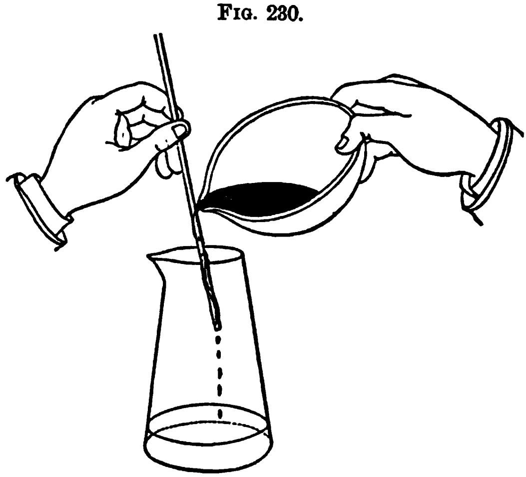
Continuous-washing apparatus.

B. S. Proctor's suggestion of two carboys may be used,—one above and inverted, containing the liquid, supported by a box having a circular hole cut in its side, and the other inside the box, containing the funnel and filter.

A modification of Gay-Lussac's apparatus is one of the most successful and practical for continuous washing (see Fig. 229). The bottle containing the wash-liquid is furnished with a doubly-perforated cork and two glass tubes: one is bent as shown in the cut, and its lower extremity curved upward. By blowing a current of air through the other tube the syphon-tube is filled, and the extremity may then be adjusted to such a height in the funnel as is desired. When the level of the liquid in the funnel falls below the orifice of the tube, bubbles of air will enter the bottle through the air-tube, and the liquid will run out until it rises in the funnel to the level of the ends of the tubes, when it will cease. It will be found a practical convenience to cut the syphon-tube just below the bend, so that a piece of rubber tubing may be used to form a flexible joint.

Decantation.—The process of separating a fluid from a solid by decantation is very simple, and consists usually in allowing the solid to deposit at the bottom of the vessel, and then carefully pouring off the liquid by inclining the vessel. The theory of washing by decantation shows its effectiveness, and this may be illustrated by the following example. If 360 grains of mercuric chloride dissolved in 50 fluidounces of water are mixed with 220 grains of potassium iodide dissolved in 50 fluidounces of water, double decomposition takes place, an insoluble precipitate of mercuric iodide subsides, and 100 grains of potassium chloride remain dissolved in the 100 fluidounces of water. As it is desirable to free the mercuric iodide from the contamination of potassium chloride, the supernatant liquid is poured off; if 90 fluidounces are decanted, 90 grains, or $\frac{9}{10}$ of the whole quantity of potassium chloride, are thus disposed of, and 10 grains are left. If the vessel is filled with water to 100 fluidounces, and 90 fluidounces are again poured off, 9 grains are again removed, and but 1 grain is left; this by a third washing and decantation in a similar manner would be reduced to $\frac{1}{10}$ of a grain, and thus the purification is speedily effected. Some skill is required to decant liquids neatly from vessels of various shapes, particularly if they are not furnished with lips, or if filled nearly to the brim. The *guiding-rod* may be used in many cases with effect: indeed, it is a good practice to form the habit of using a stirrer or rod as a guide in decanting, as shown in Fig. 230, for it has a tendency to steady the hand of the operator. The practice recom-

FIG. 230.

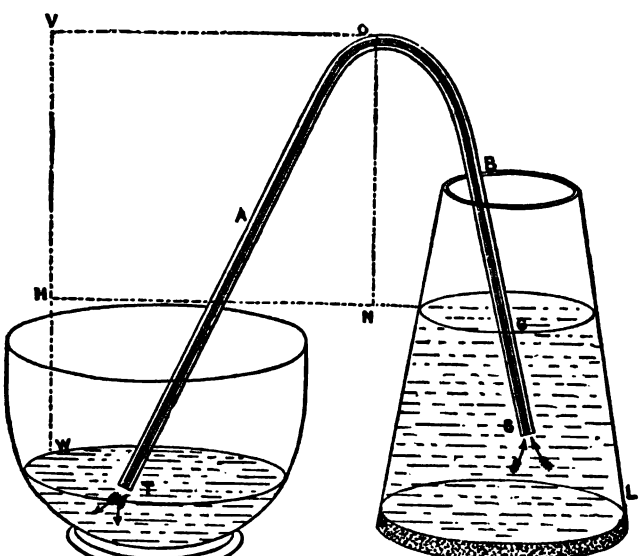


Use of the guiding-rod.

mended by some writers of greasing the rim of the vessel to facilitate decantation is a clumsy and usually unsuccessful expedient.

The Syphon (or **Siphon**).—It often happens in washing solid substances that decantation by pouring off the liquid cannot be successfully performed, either because the vessel is too full, or because, owing to the light character of the precipitate, the inclination of the vessel is sufficient to cause a disturbance in the powder, and an admixture of the liquid and solid. In such cases, and in many others, the useful instrument known as the syphon may be resorted to. This usually consists of a glass tube bent at a rather acute angle, and having one of the limbs longer than the other. It is used by filling the syphon with liquid, and then inserting the short limb into the liquid that is to be drawn off, when a flow of liquid from the long limb is established, which need not cease until as much of the liquid is abstracted as is desired. After filling the syphon the liquid may be prevented from running out (if a tube of small diameter is used) by stopping up the end of the long limb with the forefinger of the right hand, or, if the liquid to be drawn off is not caustic or unpleasant to the taste, the short limb of the syphon may be placed in the vessel at the proper height, and suction applied by the mouth at the long end until the current is established. The principle of the action of the syphon is shown in Fig. 231. The combined lengths

FIG. 231.



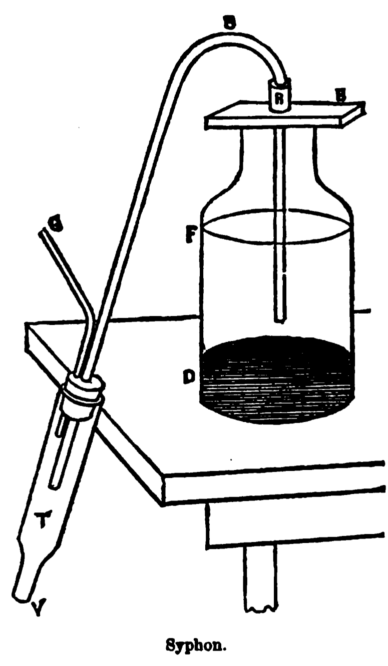
Syphon diagram.

of the limbs of the syphon are not equal to the length of the glass tube, T O S, but the real syphon is only the tube acting between the levels of the liquid in the vessels. In all operations with the syphon there must be a difference in the levels of the liquid. In Fig. 231, O S represents the liquid in the short limb, and O T the liquid in the long

limb. It is obvious that, if an equal-limbed, narrow-tubed syphon is filled with liquid, and held level in liquid on the same plane, there can be no movement in the liquid; equilibrium is established, because the tubes are equal in length and in level liquid, and the pressure of the air is the same upon all parts of the liquid. But the descending column of liquid in the long limb exceeds in weight that in the short limb, and it follows on account of the excess of weight of liquid in this limb that if it is once set flowing through the longer limb it will continue until the levels of the liquid in the two vessels are the same. It will be observed that the custom of having one limb longer than the other is not a necessity, for if there is sufficient difference between the levels of the liquid the syphon will operate with the position of the limbs reversed; but it is a convenience in a syphon of unequal limbs always to immerse the short limb, as there is then a certainty that the other limb contains the longest column of liquid. The syphon, obviously, cannot be operated in a vacuum, nor if the length of the upward column of water exceeds thirty-three feet.

Syphons for Special Purposes.—In the larger laboratory operations the most convenient syphon is made from a six-, eight-, or ten-foot length of rubber hose. This syphon, on account of its flexibility, can be used in many operations where glass or metal would be inconvenient or inadmissible, whilst its durability and simplicity of operation make it a necessity: indeed, the utility of glass syphons is greatly increased by breaking the long limb just below the bend and joining it to the other by a piece of rubber tube.

FIG. 232.



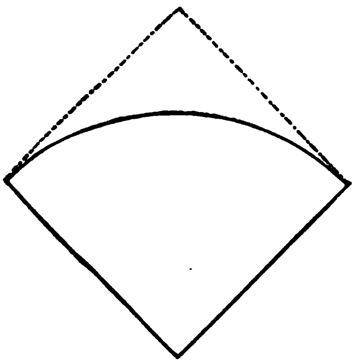
Syphon.

The method, already referred to, of starting a syphon by applying suction with the mouth at the long end, or filling the syphon with liquid, is not always practicable, and various other expedients are in use. The *syphon with a bulbed lateral tube* is useful where caustic liquids are to be decanted. The finger is placed over the end of the long limb, and suction applied at the small tube until the downward current is started. Negretti's syphon has a glass syringe attachment upon the lower part of the long limb to accomplish the same purpose. Fig. 232 represents a modification of Mohr's syphon, the bottom having been cut from a Farina cologne-bottle, T, by starting a cut with a three-cornered file near the bottom and extending it around the surface with a red-hot poker. The edges are now filed so that they are no longer sharp, and a cork is fitted and twice perforated

to admit the longer limb of the syphon, and a suction-tube, G. It is started like the syphon with a lateral tube, the moistened forefinger closing the lower aperture, V, whilst suction is being used at G until the liquid has been started. A simple glass tube, with a short piece of rubber tube attached, is in practical hands an efficient substitute for elaborate contrivances to start the flow in a syphon; even if the liquid is caustic or disagreeable, there is no risk in careful hands if the rubber tube is held between the thumb and finger so that it can be instantly pinched tightly to prevent the upward flow of the liquid into the mouth.

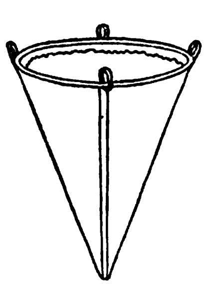
Colation, or Straining (*colare*, to strain), is the process of separating a solid from a fluid by pouring the mixture upon a cloth or porous substance which will permit the fluid to pass through, but will retain the solid. This operation is frequently resorted to for separating sediment or mechanical impurities of various kinds from liquids. Gauze, fine muslin, cotton flannel, woollen felt, and other fabrics are used. Strainers are employed where the solid particles to be removed are not in very fine powder, or where complete separation is not especially desired.

FIG. 233.



Pattern for strainer.

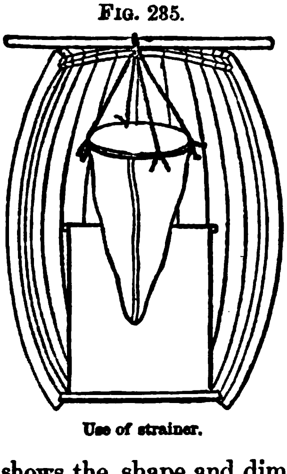
FIG. 234.



Strainer.

Felt Strainers are usually in the shape of felted, seamless, conical bags; the material is of wool and quite thick: they form excellent strainers for melted fats, petrolatum, wax, oils, syrups, elixirs, etc., where a large quantity of substance is to be strained. Their expensiveness is, however, an objection to their use, and the difficulty of cleaning them, owing to the tenacity with which they retain odors, unfits them for general use by the apothecary, but for special purposes in manufacturing pharmacy they are very useful.

FIG. 235.



Use of strainer.

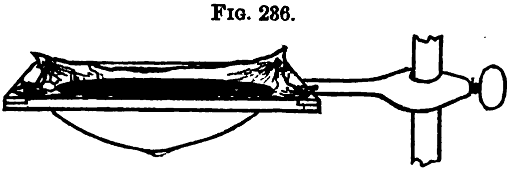
Woollen Strainers made of twilled woollen cloth, flannel blanket material, etc., are more economical, because they can be cut to any size desired, and the material costs less, whilst if the seams are closely sewed or overseamed they will last a long time. The form known as Hippocrates's sleeve (see Fig. 234) is that generally used. Fig. 233 shows the shape and dimensions before being sewed. A wooden hoop or brass ring is required to keep the opening extended. This should

be arranged so that it can be removed when the bag is to be washed. The most convenient support is a stick passed through the cords which are attached to the strainer, the whole suspended in a barrel arranged as shown in Fig. 235. The object of suspending it in the barrel is to avoid currents of air, which, in the case of many liquids, would cause evaporation from the surface and the formation of a crust, and thus impede the rapidity of colation. A tin or copper can of proper size may be placed in the barrel to collect the strained liquid.

Cotton-Flannel or Canton-Flannel Strainers are cheaper than those of woollen, and if bleached they have the great advantage that they can be used for alkaline solutions. The unbleached cotton flannel is probably stronger, but the coloring-matter naturally present, being soluble in alkalies, is apt to discolor the liquid.

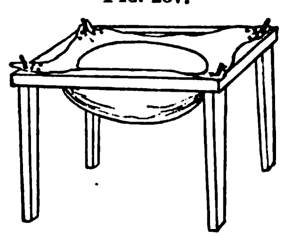
Cotton-Cloth or Muslin Strainers are generally suspended on a wooden frame, as shown in Fig. 236. The frame should be securely joined without glue, and at

FIG. 236.



Cotton-cloth strainer.

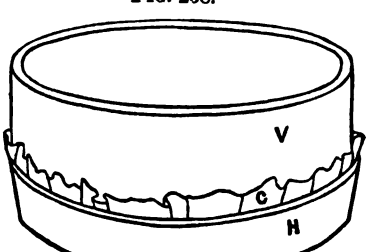
FIG. 237.



Strainer and frame.

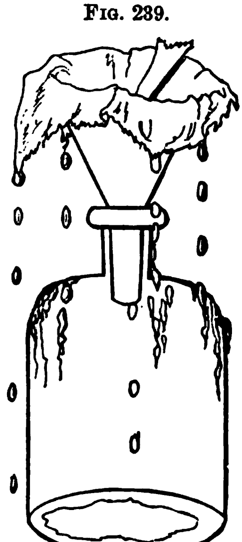
each corner there should be a strong, pointed nail projecting slightly outward. The cotton cloth should always be soaked in boiling water before fastening it to the frame, to dissolve out the substances used by the manufacturer in calendering the goods. Fig. 237 shows the method of fastening the strainer to the frame. It should be secured at each corner, first upon the permanent nails, and then two tacks upon the side of each nail should be driven

FIG. 238.



Prescription strainer.

FIG. 239.



Careless straining.

two-thirds of their length into the frame; this partial driving of the nail is sufficient to hold the cloth and permit of the easy removal of the

tacks. A strainer hung in this way will hold more liquid and do much better work than one which is tacked all around the frame. This method of straining is particularly useful in collecting precipitates which require washing.

Colation in Smaller Operations.—When solid particles are to be separated from liquids in the operations of the dispensing counter, several methods may be used. One of the most convenient is to insert a plug of absorbent cotton in the neck of a funnel and then pass the liquid through; a funnel with a circle of brass-wire gauze soldered in it two-thirds of the way down is sometimes used, although not recommended, because of the difficulty of cleaning it. A better small strainer is made by using the hard-rubber sieve, V H (see Fig. 238). The muslin gauze, C, is easily replaced, and the sieve may be placed in a funnel. The cotton cloth used by the makers of cheese, called cheese-cloth, is admirably adapted for many kinds of straining. When coarse muslin strainers are used for the first time, they are prepared by soaking them in hot water and placing them in a funnel carefully so as to line the inside. Care should also be taken to see that the strainer is not too large, for if the wet strainer projects over the edge of the funnel, a syphon action may be set up and more of the liquid delivered outside of the bottle than inside. Fig. 239 shows the action of such a strainer.

QUESTIONS ON CHAPTER X.

SEPARATION OF FLUIDS FROM SOLIDS.

What is meant by lotion or displacement washing?
How may it be effected?
What is a spritz bottle, and what is its use?
What is continuous washing?
How may it be effected?
What is decantation?
What is a guiding-rod, and how is it used?
What is a syphon?
What is the principle of its action?
Where a poisonous, caustic, or disagreeably tasting liquid is to be drawn off by a syphon, how may it conveniently be started?
What is colation?
What materials are used for the purpose?
In what cases are strainers used?
What are felt strainers?
How are woollen strainers used?
What advantages have cotton flannel strainers over those made of woollen?
How are muslin strainers used?

CHAPTER XI.

FILTRATION.

Filtration is the process of separating liquids from solids with the view of obtaining the liquids in a transparent condition. The intervention of porous substances, called *filters*, to intercept the solid particles, is necessary in performing this process. These are usually made from paper, paper pulp, sand, asbestos, ground glass, charcoal, porous stone, etc. The liquid which has passed through the filter is called the *filtrate.*

Paper Filters are the most useful of all kinds for the pharmacist, and they are employed in all the finer operations requiring filtration. The solid particles are much more completely separated by filtration through good paper filters than through strainers, owing to the pores of the paper being smaller and more numerous. The paper used for this purpose is especially prepared, and is called *filtering-paper:* it is made now upon a large scale, and can be had of excellent quality. Unlike a strainer, it is never used more than once; its cost is so trifling, and it is so easily ruptured when wet, that it is not worth while to attempt to save filters for subsequent use. Filtering-paper is found in commerce in two forms,—in large, nearly square sheets, and in circular sheets. The former is used for large filters, and has some advantages, if the waste pieces can be put to use; but it is usually more convenient for the pharmacist to rely for constant use upon the circular sheets of different sizes: the difference in price between the two is now so trifling that the latter is almost always preferred. Two kinds of square-sheet filtering-paper are commonly found,—German white, a rather thin, but good paper, and heavy French, the latter very thick and porous, having a rough surface; it is the more expensive paper, but is better for special purposes. Of the round filters, the French, Swedish, German, English, and Scotch are among those best known in America. For pharmaceutical purposes the French filters are almost universally used, the "Prat Dumas" brand being the most common, the gray paper being made from a mixture of cotton, flax, wool, etc.; this paper answers sufficiently well for filtering colored liquids, fluid extracts, or tinctures, but, owing to the coloring matter it contains, it should never be used for any solution containing free alkali.

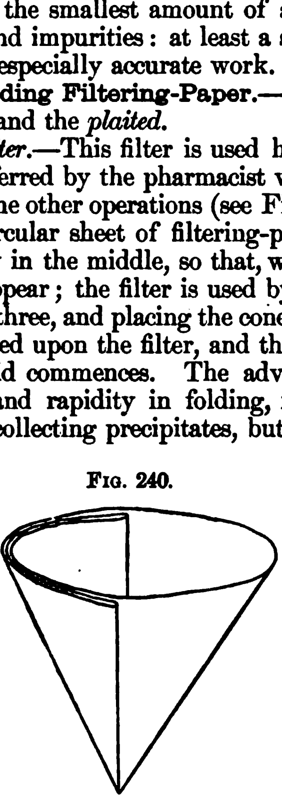
It is safer to form the habit of never using it for liquids that are intended to be colorless when filtered; of course it is entirely unfitted for analytical work. The "Prat Dumas White" is of good quality, and it or some other good quality of white paper should always be on hand

for special purposes, for filtering alkaline or alkaloidal solutions, and for the nicer operations. Very good filtering-paper of English and Scotch manufacture may occasionally be procured; that made in Sweden, however, by Munktell, is preferred for the processes of ignition and analytical work; it yields the smallest amount of ash, and is practically free from soluble salts and impurities: at least a small stock should be kept by pharmacists for especially accurate work.

Methods of Folding Filtering-Paper.—Two kinds of paper filters are used, the *plain* and the *plaited.*

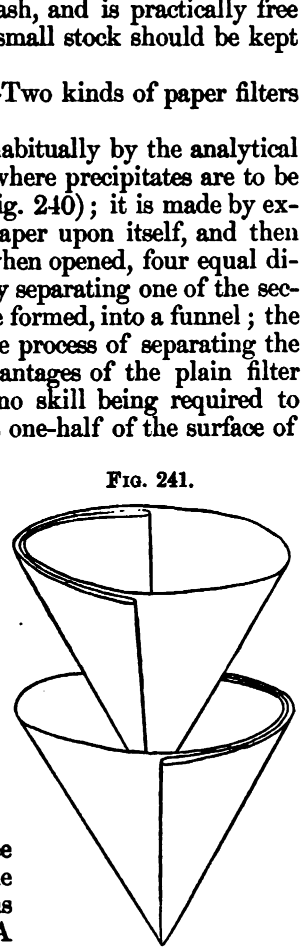
1. *The Plain Filter.*—This filter is used habitually by the analytical chemist, and is preferred by the pharmacist where precipitates are to be collected, and in some other operations (see Fig. 240); it is made by exactly doubling a circular sheet of filtering-paper upon itself, and then folding this directly in the middle, so that, when opened, four equal divisions or sectors appear; the filter is used by separating one of the sectors from the other three, and placing the cone formed, into a funnel; the liquid is then poured upon the filter, and the process of separating the solid from the liquid commences. The advantages of the plain filter are, 1. Simplicity and rapidity in folding, no skill being required to make one. 2. In collecting precipitates, but one-half of the surface of the filter (two sectors) is in contact with the moist precipitate, which is often closely adherent, and therefore but one-half of the surface has to be cleaned. In some cases there may be a disadvantage in the use of the plain filter, owing to the unequal rate of flow,—the tendency of the three folds being to attract the liquid to the side of the funnel upon which they rest, and thus the precipitate may be unequally washed. A stronger and more rapid filter may be made by placing one plain filter inside of another, so that the three sides of the upper one shall be in contact with one side of the lower one, and *vice versa* (see Fig. 241). If the sides of the funnel have an angle of 60°, the plain filter made as described will fit the funnel properly; but it frequently happens that the angles of funnels vary, and if an ordinary plain filter is placed in a funnel not having an angle of 60°, a portion of the filter is left unsupported, and the weight of the liquid is apt to rupture the moist paper. This difficulty may be overcome by making a fresh crease in the outside fold of the plain filter; if this is made to the right of the original crease of the 60° filter, and the inside fold pushed around a corresponding distance,

FIG. 240.



Plain filter.

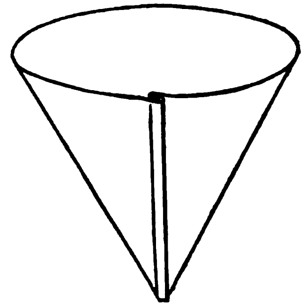
FIG. 241.



Double plain filter.

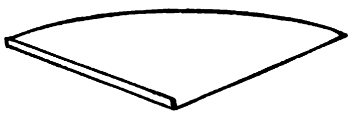
a filter having a smaller angle is produced, whilst if the fresh crease is made to the left of the original crease a larger-angled filter may be made. Rother's method of making a plain filter has the advantage of giving two filters from the same sheet that is usually required for one filter. To make it, the circular disk of filtering-paper is cut through in the line of its diameter, and half of the disk is folded into two equal parts; the double edge of the cut sides is turned down and folded over on itself narrowly several times (see Fig. 242), and with the blade

Fig. 243.



Rother's filter.

Fig. 242.

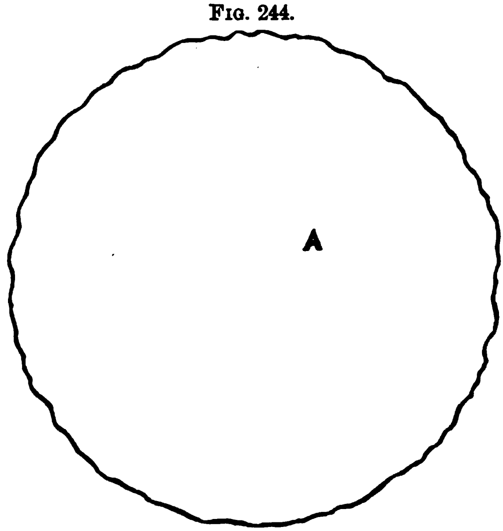


Rother's filter (first step).

of a spatula the fold is compressed so that it will retain its shape (see Fig. 243). This filter may be used in collecting precipitates.

The Plaited Filter may well be called the "pharmacist's filter," for it is the form almost exclusively used in ordinary filtering operations. Figs. 244 to 254 show the progressive steps in the folding of a plaited filter. It is made by folding a circular sheet of filtering-paper twice, as in making a plain filter.[1] The edge B D, Fig. 247, is then laid upon E D, and the crease F D is formed; in like manner C D is laid upon E D, and H D is formed. Then D B is laid upon F D, and I D is formed, and by rolling over the fold in the same direction once more until F D is laid upon E D, the crease K D is made (see Fig. 249). Now in the same way C D is laid upon H D, and H D upon E D, and it will be noticed that the folded semicircle has been creased into eight equal spaces, and that the direction

Fig. 244.



Filter.

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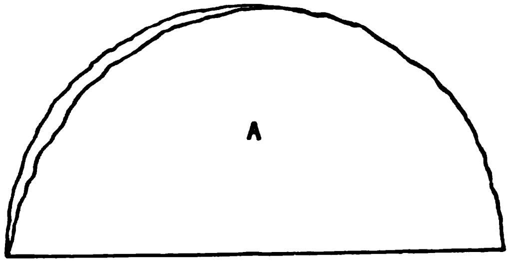
[1] It will be observed that in the first folding of French filters, "Prat Dumas," the disks are not perfect circles: this causes one edge to project (see Fig. 245), and facilitates the opening of the filter.

of each crease is the same, so that if the paper is lifted it will appear as shown in Fig. 251.

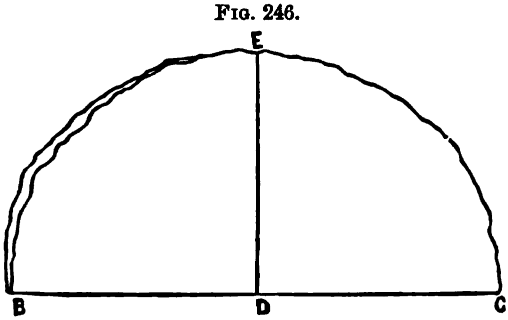
The next step is to fold each one of these spaces *back on itself* (Fig. 252). BD is laid upon FD, and then BD is turned upward and back until it is laid upon ID. This makes the crease QD, which is the first fold in the opposite direction. Taking both folds between the fore-fingers and thumbs of both hands, the edges BD and ID are folded upward and back upon FD, and the crease PD is formed; then these three edges, BD, ID, and FD, are taken all together and folded back upon KD, and the crease OD is formed, and so on, each space in turn being folded back in the opposite direction, until the last one is reached. The folded filter is then held at the apex with the left hand upon a table or flat counter, and pressed and smoothed out with the right hand in order to emphasize the folds: it should then be placed in the funnel, whilst still *unopened*, to see whether it needs trimming; if the rough edges of the filter project above the top of the funnel, the filter must be removed, and they must be cut off neatly with a sharp knife or a pair of scissors so that the whole of the filter may be placed inside of the funnel. Having satisfied this re-

FIG. 245.



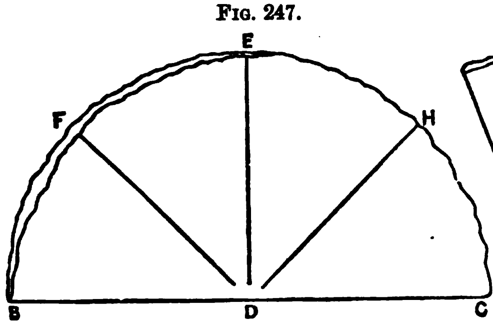
Folding plaited filter.

FIG. 246.



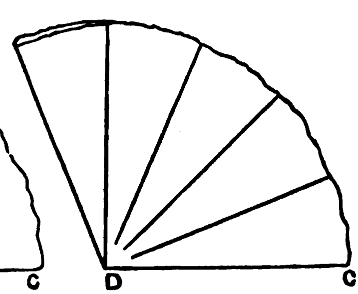
Folding plaited filter.

FIG. 247.



Folding plaited filter.

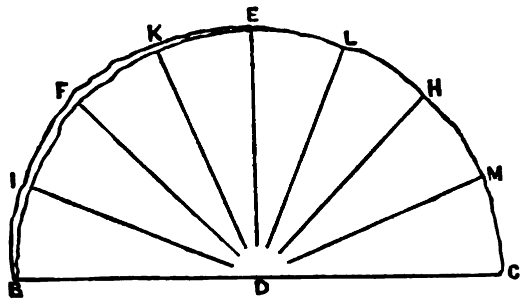
FIG. 248.



Folding plaited filter.

quirement, the filter should be carefully opened out (see Fig. 254) and placed in the funnel.

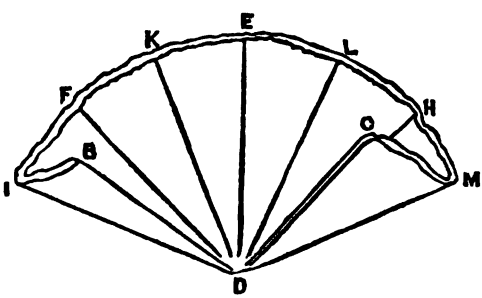
FIG. 249.



Folding plaited filter.

Another method of folding a plaited filter is illustrated in Figs. 255 and 256. A plain filter is folded as in Fig. 240, and the quadrant, consisting of four thicknesses of paper, beginning at the left-hand side, is folded at once into narrow parallel plaits backward and forward. Fig. 255 represents the filter after being once opened, and Fig. 256 shows the inside of the filter: it will be observed that the creases do not converge to a point as in the plaited filter (see Fig. 254), and hence the apex is less likely to be weakened.

FIG. 250.

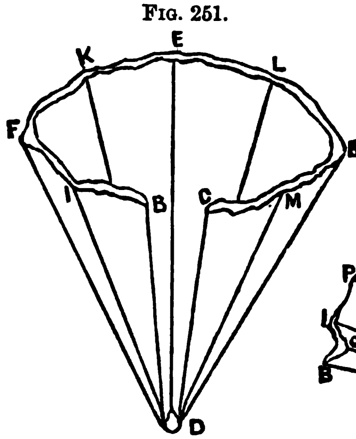


Folding plaited filter.

Maxims.—1. In folding a filter, care should be observed not to extend the creases entirely to the apex, but to end them at a distance of about half an inch from it, because the point at which all the creases converge would be thereby so weakened that the weight of the liquid would rupture the filter.

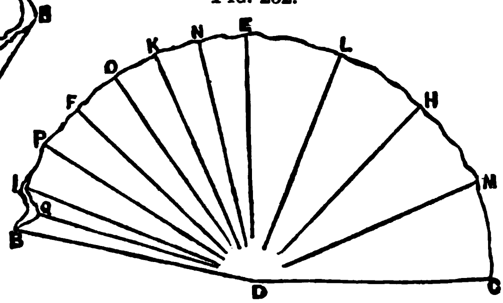
2. The filter should be moistened with water after introducing it into the funnel and before pouring upon it the liquid to be filtered (except, of course, in the case of a liquid immiscible with water): this promotes

FIG. 251.



Folding plaited filter.

FIG. 252.

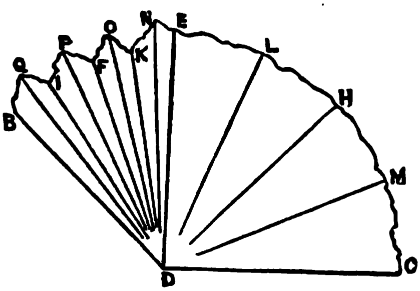


Folding plaited filter.

rapid filtration, and washes the filter besides. If hot water is available, it is usually to be preferred.

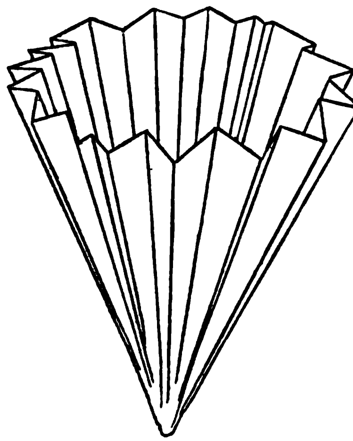
3. If the liquid to be filtered contains free acid or alkali, or if it contains a very fine precipitate, or is very dense or hot, a double filter should be used. In the case of plain filters, they should be arranged as in Fig. 241. If plaited, two sheets of paper should be taken and folded as if they were single. A filter may be also strengthened by placing a small capping filter or plain filter, a piece of well-washed linen or muslin folded

Fig. 253.



Folding plaited filter.

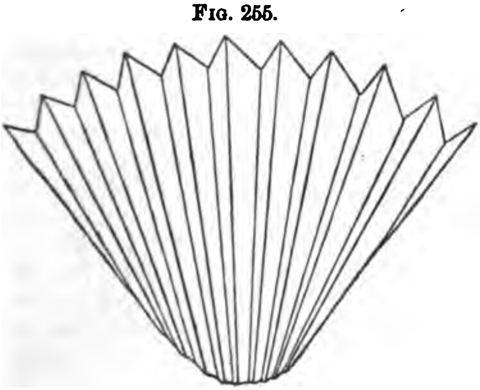
Fig. 254.



Plaited filter.

like a plain filter, or a plug of absorbent cotton, into the funnel before introducing the filter. The apex is always the weakest, the most exposed, and yet the most important part of the filter.

Fig. 255.



Plaited filter, parallel folds.

4. In pouring the liquid into the filter, the stream should never be delivered directly upon the apex, but upon one of the sides, so that the force of the fall will be broken before the weakest point is reached.

5. The filter should be entirely within the funnel. If the edges of the paper project above the funnel, waste from evaporation in volatile liquids, also from the increased and unnecessary absorption due to the excess of filtering-paper, ensues, and in addition an untidy and careless habit is encouraged.

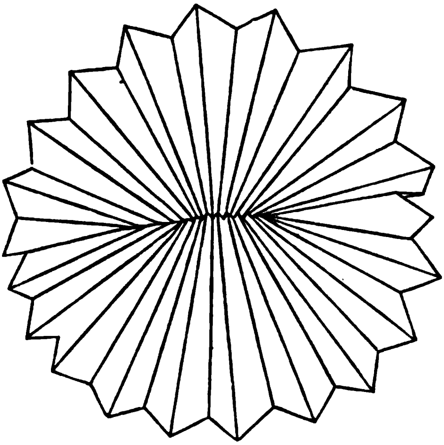
6. The end of the funnel should touch the side of the receiving vessel, so that the filtrate will trickle down its inside edge: by this expedient splashing will be avoided (see Fig. 257).

7. In filtering into a bottle, care should be observed to leave sufficient space between the neck of the funnel and the mouth of the bottle

for the escape of air, otherwise filtration will be retarded or prevented; a piece of twine placed between the two surfaces generally serves a good purpose. *The end of the funnel should project below the lowest part of the neck of the bottle* (see Fig. 258). If the diameter of the end of the funnel is too large to admit of this, or if it is only half inserted, the filtrate will be very apt to fill the intervening space and flow over the outside of the bottle, as shown by the arrows in Fig. 259.

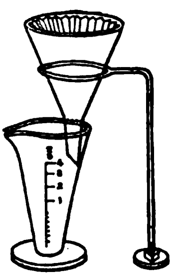
Funnels, sometimes called *tunnels*, are conical-shaped instruments intended to facilitate the pouring of liquids into narrow-mouthed vessels, and, as they have also an important service to perform for the pharmacist in supporting filters, they will be considered in this place. Funnels are made of tinned copper, tinned iron, hard rubber, Berlin-ware, porcelain, queen's-ware, granite- or agate-ware, earthen-ware, or glass. Metallic funnels have an advantage in point of durability over porcelain and glass, but a disadvantage in being acted upon chemically by liquids and in being more difficult to clean. The triangle formed by the sides of a funnel, and the line joining them, should be equilateral (see Fig. 260). The angles being each 60°, a funnel having this shape will accurately support a plain filter made in the usual way. Funnels are frequently fluted, grooved, or ribbed on the inside for the purpose of

FIG. 256.



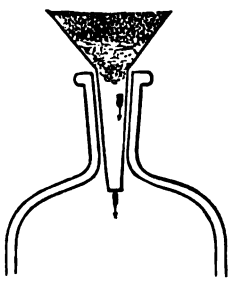
Plaited filter, parallel folds.

FIG. 257.



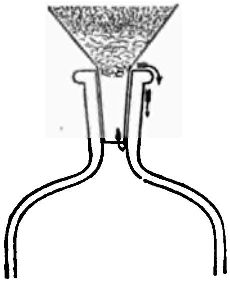
Arrangement of funnel in filtration.

FIG. 258.



Filtering into a bottle (proper method).

FIG. 259.

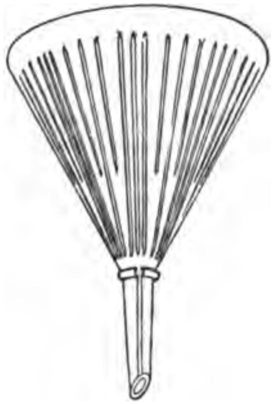


Filtering into a bottle (improper method).

facilitating the downward flow of the filtrate (see Fig. 261), or wire frames, either fixed or folding, are arranged in a plain funnel with the same object. These aids are of doubtful utility, however, whilst the tendency of the raised ribs is to form a lodgment for foreign substances.

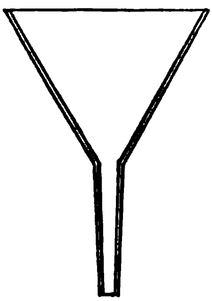
A well-made plaited filter in a plain funnel will perform as much work in the same time, and if the habit is once formed of always carefully and skilfully folding a filter, its importance in saving time and labor will be appreciated ever afterwards. One of the ribbed funnels in the market has an improvement in the neck, which, instead of being round, is triangular. This permits the free escape of air from the interior of a bottle, and is much superior to the indistinct groove which is often made on the outside surface of porcelain funnels.

Fig. 261.



Ribbed funnel.

Fig. 260.



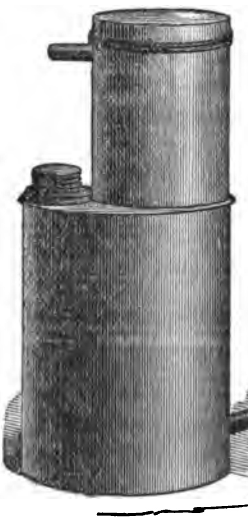
Plain funnel.

Plain glass funnels are more generally useful to the pharmacist than any other kind. They are easily cleaned, and dirt upon them may be quickly seen. They are very useful as percolators, and the whole process of filtration or percolation may be observed without trouble. Their only disadvantage is the ease with which they are fractured. The next kind in point of usefulness is the plain tinned-copper funnel. The neck should be made square or triangular, instead of round. Copper funnels are far superior to those made from tinned iron, and the difference in cost is greatly in favor of tinned copper, if true economy is considered. Hard-rubber funnels are light in weight, and are not very easily broken, for they may be often dropped upon the floor without injury. They are not acted upon by chemical substances, and with ordinary care will last a lifetime. They lack one advantage of those made from glass, however, in their absence of transparency. One or two hard-rubber funnels may be usefully employed at the dispensing counter. Porcelain, queen's-ware, or Berlin-ware funnels are, of course, not transparent; and they have the disadvantage, at least in the larger sizes, of being heavy. They are, however, not affected by liquids, but their advantages over glass are so slight (being somewhat less fragile) that they are not often employed. Earthen-ware funnels, if well glazed, are very useful in filtering *hot liquids*. Enamelled funnels, called granite- or agate-ware, etc., are made from sheet-iron having the surface entirely covered with a glazed composition which resists the action of most chemical substances. If carefully used, they answer for many purposes. Their greatest objection arises from the brittleness of the enamel, which is apt to chip off if the funnel is dropped upon the floor or subjected to a blow; and at the point where the neck of the funnel is joined to the body, the enamel coating is so thin that by constant use and knocking about it is soon chipped off, the exposed iron quickly rusts, and the neck breaks off from the body. Tinned-iron funnels are most largely used, and are popular because of their cheapness; but it is quite possible for a pharmacist to ruin in one operation a preparation

worth ten times the cost of the funnel by filtering it through a tinned-iron funnel and allowing it to come in contact with the iron exposed by the wearing off of the tinned surface.

Filters for Special Purposes.—In the course of laboratory work it frequently happens that large quantities of liquids require filtering, and the methods suitable for smaller operations cannot be profitably employed: the filtration and purification of water often become necessary. Charcoal in some form is frequently employed, not only on account of its porous character, but also because of its power of absorbing odors and depriving liquids of color. Sand, powdered glass, or asbestos forms an excellent filtering-bed. A very practical and inexpensive charcoal filter is shown in Figs. 262 and 263. It was devised by Dr. Hadden, and is illustrative of a principle in filtration not heretofore treated of in this work,—*i.e.*, *upward filtration*. It is believed by the advocates of upward filtration that great economy is secured by passing the cloudy liquid upward through a filtering-bed, the principle of action being that impurities settle away from the filtering medium by the force of gravity, instead of accumulating upon it and clogging the pores. Figs. 262 and 263 show an external and a dissected view of the filter. A gallon tin can has a short pipe soldered to it near the bottom; the pipe has a piece of perforated tin or gauze soldered over the opening into the can, to keep it from being filled up. This can is filled with clean gravel. The smaller quart can is connected with the lower one by a raised perforated tin diaphragm, and small pieces of charcoal are packed upon the diaphragm; the upper perforated diaphragm is movable, and is intended to keep the charcoal in place. A disk of coarse cotton flannel should be placed on top of the charcoal, to keep the fine charcoal-dust from working through the top to the upper tin can: this is kept in place by a screw-joint and washer such as is often seen on fruit-cans. About an inch from the top of the can is a small piece of pipe for delivering the filtered water. This filter is, of course, intended to be used in cities and towns, or where water is supplied under pressure. Both the supply- and the exit-pipe should be of proper diameter to permit the use of rubber tube for connecting with the water-supply and delivering the filtered water. The filtration of oils is often effected in a similar manner, one of the

FIG. 262.



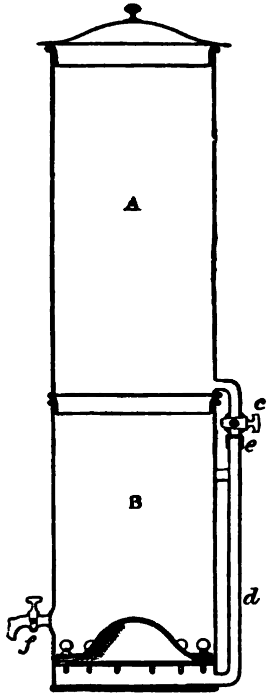
Hadden's filter.

FIG. 263.

Hadden's filter (interior).

earliest applications of this principle being the oil filter or strainer of Wm. R. Warner, of Philadelphia (see Fig. 264). This filter or strainer consists of an upper cylindrical tinned-iron vessel, A, about twenty-two inches high and ten inches in diameter, with a flange-rim soldered on the bottom, of rather less diameter, and about an inch wide, so as to fit firmly into the open top of another cylindrical tin vessel of the same diameter and eighteen inches high. The upper vessel is furnished with a lid, and with a tube and stop-cock, *c*, which penetrates the side close to the bottom, and fits into another tube, *d*, at *e*, which tube opens into the lower vessel close to its bottom and is secured to the side of B by a strong tubular stay. The filtering medium is a cone of hat-felt projecting upward from near the bottom of the lower vessel, and secured by thumb-screws passing through two tinned-iron rings and the felt, which are all properly pierced for the purpose. The stop-cock *c* being closed, the upper vessel is fitted in its place, and the tube-joint *e* rendered tight by wrapping twice around it a strip of isinglass plaster well moistened. When this is dry, the upper vessel is filled with the crude oil, and the stop-cock *e* opened, that the oil may flow into the open space below the filter. A heat of 120° F. is preferred to facilitate filtration or colation, and the filtered oil, as it accumulates in B, should be drawn off, as any large amount greatly retards the process by decreasing the force of the column bearing on the filter. For a pressure filter or strainer, Prof. B. S. Proctor uses a quadrangular cloth filter-bag securely tied to the end of a tin tube five feet long. The extremity of the tube has a wire ring soldered to it, to keep the bag from slipping off.

FIG. 264.



Warner's filter.

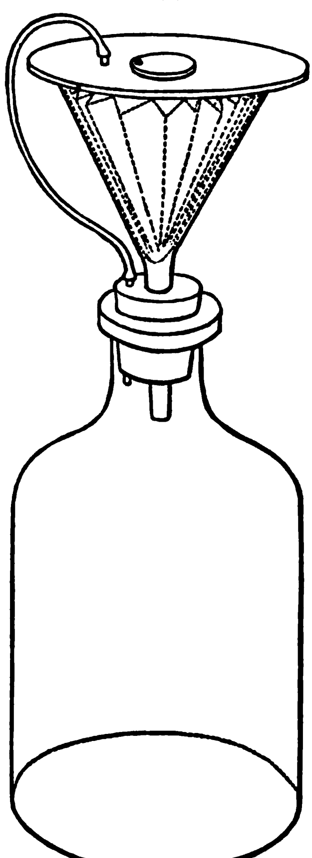
Continuous Filtration.—Most of the expedients used in continuous washing (see page 209) are applicable to continuous filtration.

Filtration of Volatile Liquids.—It is evident that the ordinary methods of filtering liquids will not be practicable for very volatile liquids, because of the loss through evaporation, and the liability to explosion, in the case of inflammable volatile liquids, if brought in contact with flame. Funnels must be covered, and provision made for the escape of the confined air in the receiving vessel. The following method is preferred to the elaborate expedients usually recommended. A glass tube (one of those usually sold as julep-tubes answers very well) is arranged in a glass or metallic funnel, so that the tube will lie close to the side of the funnel and allow one end to project above the filter, but not above the edge of the funnel: it may be held in its place by a ring of absorbent cotton gently thrust into the throat of the funnel. Or a rubber

cover perforated to admit a tube is placed on top, and connection between the bottle and funnel effected as shown in Fig. 265. For larger operations, Dr. Hadden's water-filter or Warner's oil-filter (see pages 224 and 225), slightly modified to suit the liquid, might be used. A very neat method of filtering volatile liquids is provided in the apparatus contrived by E. H. Hance, of Philadelphia. This consists of a cylindrical vessel provided with a tubulure and stop-cock below, and a ground-glass cover above; a flange near the top affords support for a perforated filter-support or funnel containing a filter. When not needed for filtration, the receiving vessel is very useful for many other purposes.

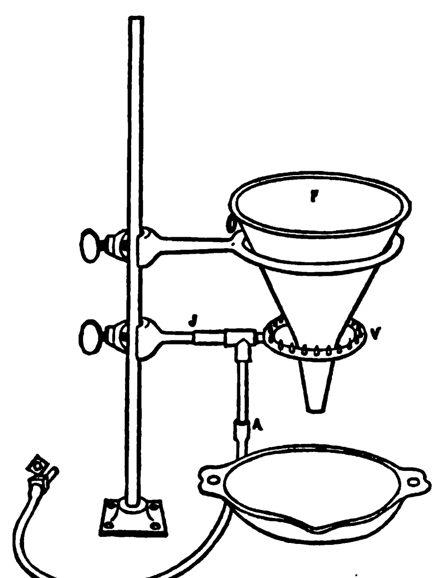
Hot Filtration.—This process is not resorted to as frequently as it might be with advantage, because of the difficulties which are asserted to attend it. These have been greatly overestimated, for by the use of simple, properly-contrived apparatus many preparations which heretofore have been dispensed, bearing an unsightly cloudy appearance, can be greatly improved. Yellow wax is frequently full of mechanical impurities; ordinary straining will not deprive it of these, but it may be filtered through paper and thoroughly purified. Jellies, benzoinated lard, petrolatum, cerates, ointments, etc., may thus be filtered. One of the simplest and most easily managed forms of apparatus (see Fig. 266) is made by filing off the ring from one of the ring-supports

FIG. 265.



Filtration of volatile liquids.

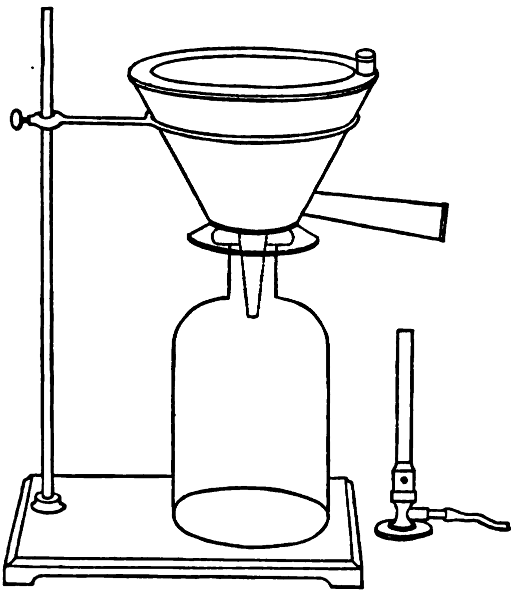
FIG. 266.



Hot filtration.

of a retort-stand, J, and slipping on to the arm a brass circular jet, V, attached to a tee carrying the gas-supply pipe, A. A tinned-copper or tinned-iron funnel is supported by an appropriate ring at a suitable distance above the jet. The filter is placed in the funnel, a receiving vessel adjusted below, and the hot liquid poured into the filter. It is plain that the liquid can be heated to almost any degree, and the filtration conducted at a much higher temperature (if need be) than by the jacketed hot-water funnel (see Fig. 267), and, on the other hand, the heat may be regulated so that it will be very moderate. The hot-water funnel is an old device, and consists simply of a jacketed funnel having a wide tube soldered at the lowest point, and an opening in the upper edge for the water-supply. A burner or a lamp-flame will heat the water contained between the funnels, and a regulated heat not exceeding that of boiling water is obtained (see Fig. 267).

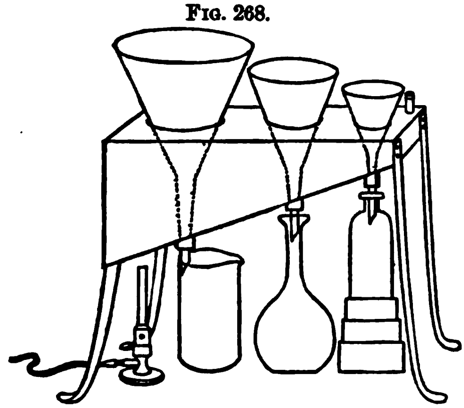
FIG. 267.



Jacketed funnel.

A modification of Dr. Hare's hot-water filter, which permits the use of glass funnels of different sizes, is shown in Fig. 268. It is simply a tinned-copper box, with two sides shaped like a trapezoid, and supported upon four legs. There are three one-inch tubulures in the bottom, and the top has three openings which centre with the tubulures; beginning with the deepest, the diameters are four, three, and two inches. Three glass funnels of different sizes are selected, and the corks for the tubulures in the bottom, having been chosen, are perforated so as to permit the necks of the funnels to pass through and form perfectly tight joints. Water is placed in the box and heated by the burner, as shown in the cut. When

FIG. 268.



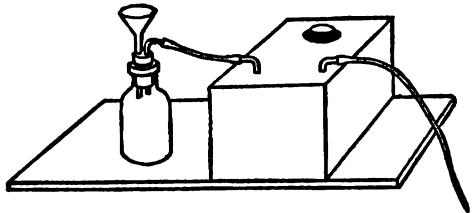
Hot filtration.

not needed for hot filtration, solid corks may be used to close the tubulures, and the box used as a water-bath, covers being placed over the openings which are not in use.

Rapid Filtering Apparatus.—Of late years much attention has been expended upon methods of increasing the rapidity of filtration. Most of the plans suggested depend upon the principle of filtering into a partial vacuum, but the means used to obtain this vacuous space are very varied. A simple method, applicable to operations on the small scale, consists in fitting a good cork to a wide-mouthed bottle and perforating it so that the neck of a funnel will accurately pass through it; another perforation permits the insertion of a piece of glass tube of small diameter. A plain filter of well-washed coarse linen or muslin cloth is then carefully adjusted in the funnel, and a plain filter of paper placed upon it. The liquid is poured upon the filter, and, a rubber tube having been fitted to the glass tube, suction is applied by the mouth. By pinching the rubber tube a partial vacuum is maintained in the bottle, and filtration is hastened. An improvement upon this would be to use a rubber stopper instead of cork, and instead of pinching the rubber tube to use a screw pinch-cock.

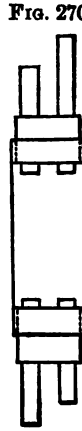
Water-Pumps acting by a Fall of Water.—One of the first practical efforts made in the direction of using water-power was seen in Bunsen's pump. The action depends upon the principle that a column of water descending through a tube from a height is capable of sucking with it the air contained in a lateral tube, if the latter is properly arranged. A cheap home-made apparatus, which depends upon a fall of water for its usefulness, is shown in Fig. 269. It consists of a common wide-mouthed half-gallon jar, and a tinned-iron can holding three, four, or five gallons; a castor-oil can answers very well. The screw-cap is for readily filling the can; the exhaust-pipe on the right reaches inside of the can, nearly to the bottom, the other tube is soldered on the head of the can connecting with the interior. The jar, having a funnel fitting into it through an air-tight stopper, is connected with the can by means of a bent glass tube and rubber tube. The can is filled with water, and the solution to be filtered is placed in the funnel. The exhaust-pipe is connected

FIG. 269.



Rapid filtration.

FIG. 270.



Lux's aspirator.

FIG. 271.

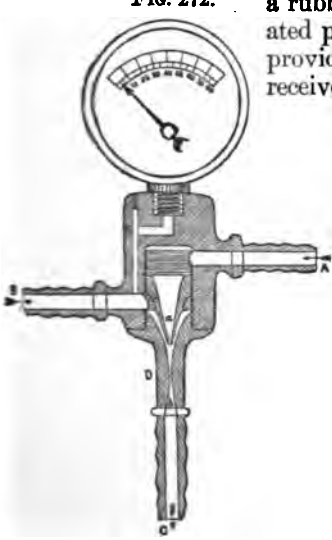
Rapid filtration.

with a rubber tube eight or ten feet long and a quarter of an inch in diameter (the longer the tube the more rapid is the filtration). When the

syphon thus formed is started, the flow of the water from the can carries with it the air from the bottle. (N. R., 1881, p. 266.)

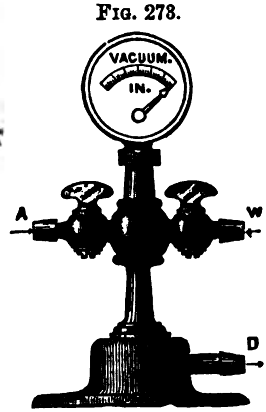
Lux's aspirator (see Fig. 270) is constructed by fitting two accurately-perforated rubber stoppers to the ends of a piece of wide glass tubing; four short glass tubes are inserted in the stoppers, as shown in the cut. One of the tubes is for the supply of water, another carries it off, the third tube is connected with the vessel to be exhausted, whilst the fourth tube may be put to the same use, or connected with a vacuum gauge or closed with a stopper. If the air is to be aspirated by one of the lower tubes, the vessel to be exhausted must stand on a higher level than the aspirator. The length of the exit-tube determines the power of the aspirator. It should have a bore of one-fifth of an inch and be at least ten feet long, and it should be provided with a screw pinch-cock to regulate the flow of water. A very simple apparatus is shown in Fig. 271. A very moderate fall of water is needed here. It is, however, adapted only to small operations. Two rather large bottles, of equal capacity, and both provided with nipples near the bottom, are selected. Into the neck of each is fitted a tight-fitting stopper carrying a glass tube bent at a right angle, and the nipples near the bottom are connected with a rubber tube. A Woulffe's bottle having two necks is next selected, and one of the necks fitted with a tight-fitting stopper carrying a small bent tube, to which is attached a rubber tube provided with a conveniently situated pinch-cock. The other end of the bottle is provided with a stopper so perforated that it will receive air-tight a glass funnel. One of the large bottles is filled with water and placed on an elevated shelf, when the water will flow down to the other bottle: and if the connections are made as shown in the cut, it will aspirate through the funnel; and if the funnel is full of liquid, it will cause the latter to run through quite rapidly. When the lower bottle is full, it is substituted for the upper one, and the connection with the vessel to be exhausted, transferred to it.

FIG. 272.



Fisher's vacuum-pump.

FIG. 273.



Vacuum-pump.

Water-Pumps acting by Pressure.—It is usually inconvenient to operate aspirators which depend upon a fall of water through a long tube, except in high buildings: hence water-pumps which are operated by pressure are generally preferred in cities and towns, or in localities where water is supplied under pressure. The following are selected

from the great variety in use as being good illustrations of the principle. Those made of glass are not recommended, because of their extreme liability to breakage. Fisher's vacuum-pump is well shown in Fig. 272. A, B, C, are intended to receive rubber tubing, and the neck, D, may be fastened by a clamp to a retort-stand or other upright fixture. Water from the hydrant enters at A, passes through the nipple at *a*, and, being forced through the contracted portion, *b*, draws with it the air from the tube, B, which is attached to the filter. A communication is also made with the vacuum-gauge, as shown in the cut, to mark the degree of exhaustion. Schutté and Goehring, of Philadelphia, have contrived a similar apparatus, which is somewhat more convenient from their having placed it upon a base and deflected the lower tube laterally. This permits the use of the apparatus in many places where Fisher's pump could not be used. It is shown in Fig. 273. W represents the water-supply tube, D the outlet, and A the aspirating tube.

QUESTIONS ON CHAPTER XI.

FILTRATION.

What is filtration?
Of what are filters usually made?
What is the liquid that passes through a filter called?
What kind of filters are most useful and most employed?
What objection is there to the ordinary gray filtering-paper that is commonly used?
What is the difference between a plain and a plaited filter?
How is a plain filter folded?
What is its special advantage?
What is a disadvantage of a plain filter, and how may it be obviated?
What is Rother's method of making a plain filter?
What advantage has this?
How is a plaited filter ordinarily made?
How can a plaited filter be folded differently, so as to strengthen its apex?
In folding a filter should the creases extend entirely to the apex? Why?
What exceptions are there to this plan?
In what cases should a double filter be used?
How may a paper filter be strengthened?
Should a filter extend beyond the edges of the funnel? Why?
What are funnels used for?
What materials are they made of?
What angle should a funnel have?
What kind of funnels is most generally useful?
What is the advantage of tinned copper for funnels? Of hard rubber? Of porcelain?
For what purpose are earthen-ware funnels useful?
What is an objection to enamelled (called granite- or agate-ware) funnels?
What is an objection to tin funnels?
How is upward filtration performed?
Describe William R. Warner's oil-filter.
How may volatile liquids be filtered?
How may hot filtration be accomplished?
What is a jacketed funnel?
Describe Dr. Hare's hot-water filter.
How may the rapidity of filtration be increased?
How may a fall of water be made to increase the rapidity of filtration?
Describe Lux's aspirator.
Describe Fisher's vacuum pump.

CHAPTER XII.

CLARIFICATION AND DECOLORATION.

Clarification is the process of separating from liquids, without the use of filters or strainers, solid substances which interfere with their transparency. The processes of clarification and decoloration from a pharmaceutical point of view have declined in importance of late years, owing to the fact that chemical and other substances requiring the processes are supplied in a purified condition so cheaply that it is absolutely impossible for the pharmacist to compete with the manufacturer who operates on the large scale and uses apparatus and methods which are thorough and economical. This is particularly the case with sugar and the alkaloids. Formerly the apothecary bought raw sugar and clarified the syrup; now the difference in price between raw sugar and that which is pure is so slight that no one ever makes syrup from raw sugar. The decoloration of alkaloidal solutions and the manufacture of alkaloids cannot be economically attempted on the small scale by the pharmacist, because of the want of continuity of the process; the manufacturer, on the other hand, can use the animal charcoal repeatedly until its power is exhausted, and in other ways practise economy not possible to the apothecary. It is, nevertheless, very important for the student to comprehend thoroughly the principles underlying both processes.

Clarification may be effected in several ways:

1. By the application of heat. 2. By increasing the fluidity of the liquid. 3. Through the use of albumen. 4. Through the use of gelatin. 5. Through the use of milk. 6. Through the use of paper pulp. 7. By fermentation. 8. By subsidence through long standing.

1. *By the Application of Heat.*—When a viscid liquid is heated, its specific gravity is diminished, and frequently particles which were suspended in it, and interfered with the transparency of the liquid, will separate, the heavier ones falling to the bottom, and the lighter ones rising; in the latter case, ebullition facilitates the separation, the minute bubbles of steam becoming enveloped in the viscid particles rise through their buoyancy, and a scum is formed which may be readily separated. The official process for the clarification of honey (Mel Despumatum) is a good illustration of the use of heat in this connection.

2. *By Increasing the Fluidity of the Liquid.*—Clarification by this method depends upon decreasing the specific gravity of the liquid by the addition of water, alcohol, or other liquid lighter specifically than

the one to which it is added: this causes the suspended particles to subside, and the clear liquid may then be decanted.

3. *The Use of Albumen.*—The property possessed by albumen of remaining liquid at ordinary temperatures and becoming coagulated by heat renders it one of the most useful substances that can be employed in the process of clarification. Its action is mechanical, and where albumen exists naturally in the liquid, as in many fruit and vegetable juices, the simple heating of the liquid suffices to coagulate the albumen, which envelops the particles that render the liquid cloudy, and these rise to the top and are skimmed off. Albumen, or white of egg, is frequently added to liquids to clarify them; in such cases it should always be added before the liquid is heated: this is best accomplished by adding about an equal bulk of the liquid to the albumen, then introducing the mixture into a muslin strainer and squeezing it through the meshes of the cloth by gathering up the corners and spirally twisting the strainer, when the organization of the albumen is destroyed, and a smooth mixture results; the strained solution is then added to the liquid to be clarified, and the whole heated gradually (usually until it boils), without stirring, until coagulation is effected. In most cases the white of one egg is sufficient for a gallon of liquid: the error most frequently made by operators is the use of an excess of albumen. Care must be taken not to use albumen as a clarifying agent in those cases where the active principle of a liquid forms a precipitate with albumen by combining with it.

4. *The Use of Gelatin.*—Gelatin is used when tannin is present and is the cause of cloudiness, or when it is desirable for other reasons to remove it: its action depends upon the fact that gelatin forms with tannin an insoluble compound; this is, indeed, the basis of leather. Isinglass, one of the purest kinds of gelatin, is the preferred form; it is frequently employed for clarifying infusions containing tannin, such as tea and coffee, etc. It is used by adding a weak solution of the gelatin in hot water to the liquid before it is heated, and allowing the liquid to cool. The insoluble compound formed must always be strained or filtered out.

5. *The Use of Milk.*—The presence of casein in milk, and the fact that acids precipitate it in the form of a curdy precipitate, are taken advantage of in the use of milk as a clarifying agent. It is employed particularly for vinous preparations, sour wines, etc., and should not be used in excess.

6. *The Use of Paper Pulp* does not depend upon chemical combination, its action being purely mechanical. Paper pulp for filtering is best prepared by placing filtering-paper (the saved trimmings and scraps left from making filters answer well) into a mortar or other vessel, and pouring enough solution of soda or potassa on it to soak it, then stirring it with the pestle until it is reduced to a pulp. This should then be washed by placing a loose plug of absorbent cotton in a funnel and pouring in the mixture: when it has drained, water (preferably hot) should be poured upon it until all traces of alkalinity are washed out; the purified pulp may then be placed in wide-mouthed bottles until needed. It is used as a clarifying agent by adding a portion to the

cloudy liquid, agitating the mixture, and allowing the whole to stand quietly until the liquid is clear; or, as a filtering agent, after the addition of the pulp, the mixture may be thrown upon a wetted muslin strainer, and if the liquid which passes through at first is not clear, it may be returned until it is. It will be found that the particles of pulp will partially fill up the meshes of the strainer, and an excellent filtering-bed is thus formed: care should be taken, therefore, not to stir the mixture up after it is placed on the strainer.

7. *By Fermentation.*—The changes in the composition of juices after they have been fermented usually lead to the deposition of those substances which previously interfered with the transparency of the juices; the generation of alcohol through fermentation produces a liquid in which the substances are insoluble, hence the formation of a deposit. The official preparation of syrup of raspberry affords a good illustration of the principle of clarifying juices by fermentation, whilst in the manufacture of wines the principle has been known and practised for centuries.

8. *By Subsidence through long standing.*—This method involves the least possible amount of labor and expense, and it is resorted to very frequently (particularly upon the large scale) when haste is unnecessary, and whenever the liquid keeps well enough to withstand the tendency to spoil during the time necessary to effect complete separation. The deposit formed is called a *sediment:* this term is not synonymous with *precipitate. Sediment is solid matter separated merely by the action of gravity from a liquid in which it has been suspended. A precipitate, on the other hand, is solid matter separated from a solution by heat, light, or chemical action.* The fixed oils are clarified by subsidence; in the vegetable oils the sediment consists principally of albuminous and gummy substances which have been separated with the oil during the process of expression.

Decoloration is *the process of depriving liquids or solids in solution of color by the use of animal charcoal.* Decoloration is used in the abstraction of coloring-matter from fatty bodies, oils, petrolatum, syrups, honey, etc. Animal charcoal, or bone-black, which is produced by heating bones in close vessels out of contact with air, and then grinding them, is generally preferred in decolorizing operations. Wood charcoal possesses but little power in this direction. It has been generally settled that the decolorizing property is owing to the formation of insoluble compounds of the coloring-matter when it is brought in contact with porous charcoal. Animal charcoal varies greatly in its power. The official purified animal charcoal is often not so powerful as a decolorizer as the animal charcoal from which it was made; but bones contain calcium phosphate and calcium carbonate, and the object of the purifying process is to abstract these salts, because, in many of the delicate operations of pharmacy, particularly the decoloration of vegetable acid solutions, these salts would be dissolved by the acids, and the solutions thus contaminated. The most powerful animal charcoal is produced by calcining dried blood and other animal matter with pearl-ash, and afterwards washing out the pearl-ash with water, and subsequently with an acid solution: the charcoal need not be dried before using. For other

information about the properties of charcoal, see *Carbo Animalis* and *Carbo Animalis Purificatus*, U. S. Dispensatory, 17th edition, pp. 322, 323. For most decolorizing operations of the pharmacist on the small scale, the solutions, melted fats, oils, etc., can be introduced directly upon the animal charcoal, which is placed in a funnel and prevented from falling through by the insertion of a plug of absorbent cotton, or it may be arranged in an ordinary percolator, and the cold liquid percolated through the charcoal, or the liquid simply agitated with the charcoal and the mixture filtered. It is very important to remember that charcoal absorbs a number of valuable principles used in medicine,—*e.g.*, *bitter substances*, like gentiopicrin, aloin; *astringents*, like tannin; *alkaloids*, like quinine, morphine, strychnine, cocaine, etc. Charcoal has even been used as an antidote for poisoning with the alkaloids. It should always be used with discrimination and judgment, or it may be found that in striving to improve the appearance of a preparation by lessening the color its value has been sacrificed.

QUESTIONS ON CHAPTER XII.

CLARIFICATION AND DECOLORATION.

What is clarification?
In what various ways may it be effected?
How is it effected by the application of heat?
How is it effected by increasing the fluidity of the liquid?
How does albumen act in clarifying liquids?
When is gelatin useful in clarifying liquids?
How does milk act in clarifying liquids?
What is the action of paper pulp in clarifying liquids?
How does fermentation act in clarifying liquids?
What is the difference between a sediment and a precipitate?
What is decoloration, and for what articles is it used?
What substance is generally preferred in decolorizing operations?
How is the most powerful animal charcoal produced?
What valuable principles used in medicine does charcoal absorb?
For what class of substances has charcoal been used as an antidote?

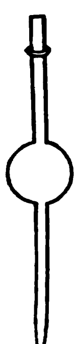
CHAPTER XIII.

SEPARATION OF IMMISCIBLE LIQUIDS.

THE separation of liquids which are mutually soluble is usually effected by distillation, if one or both of the liquids are volatile (see page 148); but the separation of liquids which do not mix with each other is generally a simpler process, and the object of this chapter is to show the methods at present in use.

Use of the Pipette.—This simple instrument consists of a narrow tube with its lower end drawn out to a capillary orifice, and a bulb, either globular or elongated, blown in it near the top; the upper edge is usually surrounded by a smooth glass ring to strengthen it. It is used by dipping the lower orifice into the liquid that is to be separated and applying suction with the mouth at the upper end; the liquid rises, fills the bulb, and, if the end of the moistened forefinger is applied to the top, the liquid may be carried some distance without running out. Fig. 274 shows the ordinary form of the instrument. Fig. 275 can be readily made from a glass syringe-tube, a perforated cork, and a piece of tube, by one unskilled in glass-blowing. Fig. 276 shows a pipette which has a piece of sheet-rubber tied over the thistle-shaped top. If pressure is ap-

FIG. 274.



Plain pipette.

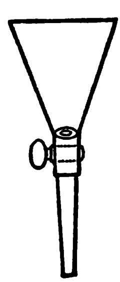
FIG. 275.

Syringe pipette.

FIG. 276.

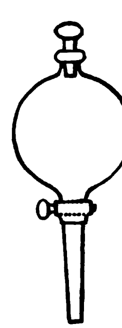
Pipette.

FIG. 277.



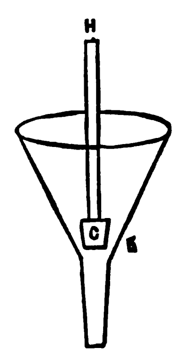
Separating funnel.

FIG. 278.



Globe separating funnel.

FIG. 279.



Mitchell's separator.

plied to the rubber, the air is partially exhausted and a slight vacuum produced; if the point of the pipette is then applied to the liquid and the pressure relaxed, the liquid will rise, and it may be transferred to another vessel. A modification of this, where a rubber bulb is attached to the pipette and used in a similar manner, is seen in Fig. 40.

Use of the Glass Syringe.—The glass ear-syringe, having a bulb

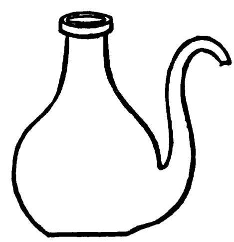
blown near the orifice, is very useful in collecting a small quantity of oil floating on top of a liquid contained in a beaker or open vessel. The piston of the syringe should be well soaked in warm water before attempting this simple but delicate operation.

Use of the Separating Funnel.—This instrument, as indicated by its name, is used to facilitate the separation of immiscible liquids. It is generally a funnel having a glass stop-cock in its neck (see Fig. 277). The mixed liquid is poured into the funnel, which is placed in position where it can come to rest, and the lower liquid is then allowed to run off by opening the stop-cock. With careful use, liquids can be separated with great accuracy in this way. Where the liquid is valuable or very volatile, as in some of the oils, the globe separator (see Fig. 278), which can be accurately closed and evaporation prevented, is preferred.

Mitchell's Separator.—Dr. Mitchell devised a cheap but efficient substitute for the separating funnel (see Fig. 279). A good cork, C, is fitted into the throat of a funnel, E, and the end of a penholder-handle, H, or other suitable wooden rod, is whittled to a flat wedge, and this forced into the cork tightly. The lower portion of the holder is notched, and the upper part of the cork is tied securely to it, or a pin may be driven through it and the cork to fasten it: it is used by forcing the cork C into the neck of the funnel, pouring in the liquids, and, when they have separated, lifting the handle H carefully until the lower liquid has entirely escaped, and then pushing it down tightly to stop the flow.

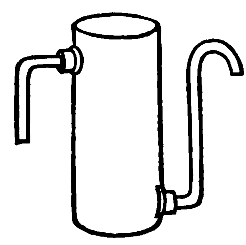
Florentine Receiver.—The separation of volatile oils from the water which usually accompanies them during distillation is a very important part of their process of manufacture. Where the volatile oil is lighter than water, the form shown in Fig. 280 is used. The mixed oil and water collect in the glass receiver during distillation, the oil floating on the top, whilst the water ascends the bent tube from the bottom; further addition of distillate causes an overflow, and the water from the bottom of the receiver is discharged through the tube into a suitable vessel; then the receiver becomes filled again gradually as distillation progresses. The process of separation is continued automatically. Where the oil is heavier than water, the method is reversed, and provision must be made for the escape of the water near the top of the receiving vessel. Labor may be saved by the use of a long-necked funnel, or by placing a funnel in a wide tube, so that the mixed oil and water may be conveyed at once to the bottom without the liability of some particles of oil being carried over through the lateral tube and necessitating a second separation.

FIG. 280.



Florentine receiver.

FIG. 281.



Receiver for heavy and light oils.

Fig. 281 shows a receiver which can be used for either light or heavy oils, one or the other tube being stopped with a cork, as the case requires.

CHAPTER XIV.

PRECIPITATION.

PRECIPITATION is the process of separating solid particles from a solution by the action of heat, light, or chemical substances. The separated solid is termed a *precipitate;* the added liquid or substance which produces the precipitate, the *precipitant;* the liquid which remains in the vessel above the precipitate, the *supernatant liquid.*

The precipitate usually falls to the bottom of the vessel. It may, however, remain suspended or rise to the top.

The objects of precipitation in pharmacy are,—

1. To obtain conveniently solid substances in the form of fine powder. Example, the precipitation of calcium carbonate.
2. To effect the purification of solids. Example, the precipitation of pepsin from its solution by sodium chloride.
3. To obtain through chemical reaction substances which are insoluble in the supernatant liquid. Example, the official preparation of red mercuric iodide.

Precipitation is largely used in testing, as it frequently affords the most ready means of recognizing chemical substances or of ascertaining their purity. A great many pharmacopœial tests are based upon this process. The color, quantity, and character of the precipitate are all taken into account. The terms *curdy, granular, flocculent, gelatinous, crystalline, bulky,* and others, which are sufficiently distinctive, are used to define the peculiar form which the precipitate assumes when thrown out of solution. A *magma* is a thick, tenacious precipitate left after the liquid is decanted.

Methods of Effecting Precipitation.—Precipitation may be produced in many ways. If solutions containing albuminous matter be *heated,* a flocculent precipitate of coagulated albumen will be thrown down; whilst if solution of the silver salts be exposed to the *light,* precipitation is apt to take place. Precipitation will usually occur when a hot saturated solution of an amorphous substance is allowed to cool, as in the preparation of antimony oxysulphide, or when to a solution is added a liquid in which the dissolved substance is insoluble, as when strong alcohol is added to a small quantity of mucilage of acacia, or water to an alcoholic solution of resin.

Precipitation is most generally effected by the reaction of chemical substances, and some of the most interesting processes in pharmacy are the results of this method of producing precipitates. When acid solutions are brought in contact with alkaline solutions, insoluble precipitates are sometimes formed, as the solution of oxalic acid with lime water, form-

ing calcium oxalate. By far the most common method is to mix a solution of one salt with a solution of another, thereby producing an insoluble precipitate, as in the official process for preparing mercuric iodide, where solution of mercuric chloride is added to solution of potassium iodide. The methods of producing precipitates are numerous, and will be noted in detail under the head of the respective substances.

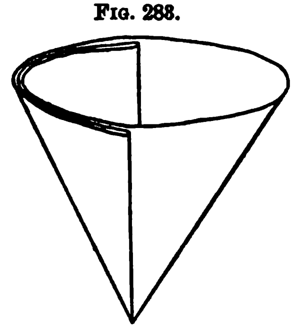
Vessels used in Precipitation.—Precipitating vessels should be deep, comparatively narrow, and broader at the bottom than at the top (see Fig. 282). This construction permits the precipitate to occupy less height in the vessel, by causing it to spread out upon the bottom; thus the supernatant liquid can be more thoroughly decanted off, the particles of the precipitate will lie in closer contact, and a better opportunity is given for the escape of imprisoned air or gas, which frequently exercises a buoyant effect on the particles and prevents their subsiding rapidly and closely. Upon the large scale, cedar tanks, of the shape just described, may be used: these may have wooden spigots introduced, a foot or so apart, so that the supernatant liquid may be conveniently run off.

FIG. 282.

Precipitating jar.

Manner of conducting the Process.—If two solutions are used, and it is known that they contain the exact quantity of solid substance to react mutually without leaving an excess of one or the other, the order in which the liquids are mixed is immaterial; but when this is not the case, and the precipitant is to be added until precipitation ceases, it is necessary to proceed with caution. The precipitant is then added gradually, and, where acid or alkaline solutions are used, litmus-paper is useful in indicating the approach of an excess. In other cases the precipitate may be allowed to subside, and the precipitant slowly dropped into the clear liquid above until it is noticed that further addition is without effect. If the precipitate is too bulky to subside quickly, the whole may be vigorously stirred until thoroughly mixed, a small portion transferred to a small plain filter, and the filtrate tested by a further addition of precipitant. If this small portion is weighed, or measured, or is a known proportion of the whole, a simple multiplication will determine about the quantity necessary to complete the precipitation. Ammonia water is one of the most useful of alkaline precipitants, because an excess is at once noticed by the odor. This is easily done by blowing the air from the surface of the liquid, thoroughly stirring up the mixture, and then noting whether it smells of ammonia.

FIG. 283.



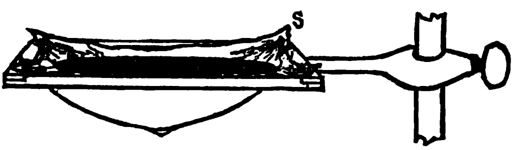
Plain filter.

The Production of Heavy and Light Precipitates.—Hot, dense solutions usually produce heavy precipitates, and such precipitates are more readily washed from adherent contaminating salts than those which are light and bulky. An additional advantage is, that they oc-

cupy less space, and consequently their dose is less bulky. A good example of this is found in the manufacture and use of heavy and light magnesium carbonate.

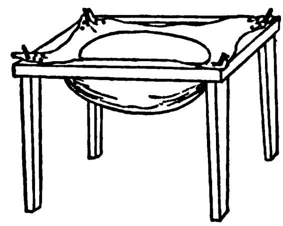
Collecting and Washing Precipitates.—In small operations precipitates are collected upon plain filters (see Fig. 283): the special advantages of such filters in this respect have been already pointed out on page 208. On a larger scale muslin strainers are generally used. These are suspended on frames, as shown in Figs. 284 and 285. In washing precipitates which

FIG. 284.



Collecting a precipitate.

FIG. 285.



Frame and strainer for precipitates.

are placed on strainers of this kind, care must be observed to close up the fissures which usually appear in the magma after it has been allowed to stand a short time, by stirring the precipitate thoroughly before adding more water. (See Lotion, Decantation, pages 208, 210.)

QUESTIONS ON CHAPTERS XIII. AND XIV.

SEPARATION OF IMMISCIBLE LIQUIDS AND PRECIPITATION.

What is a pipette, and how is it used?
What is a separating funnel, and how is it used?
Describe Dr. Mitchell's separator.
What is a Florentine receiver?
What is precipitation?
What is the separated solid termed?
What is the substance which produces the precipitate termed?
What is the liquid which remains in the vessel above the precipitate called?
What are the objects of precipitation in pharmacy?
Give examples of each of these objects.
How and why is precipitation used in testing?
What is meant by the term "magma"?
What various methods are there of effecting precipitation?
What is the best shape for precipitating vessels?
If two solutions are used to produce a precipitate, in what order should they be mixed?
If an acid and an alkaline solution are mixed, how may it be determined when the mixture is neutral, or nearly so?
Why is ammonia the most useful of alkaline precipitates?
How are heavy precipitates formed?
Are they more or less easily washed from adherent salts than light precipitates?
What advantage have heavy precipitates over light ones?

CHAPTER XV.

CRYSTALLIZATION.

Crystallization is the process whereby substances are caused to assume certain determinate forms called *crystals*. These are distinctive, and when perfect are bounded by geometrical surfaces. Those substances which are *not* crystallizable are termed *amorphous*. The objects of the process are to increase the purity and to enhance the beauty of chemical substances. The descriptions of the crystalline forms assumed by bodies form the basis of the interesting science of *crystallography*. In a work of this kind it is impossible to give more than a very brief sketch of the outlines of the classification, since the practical process of crystallization must receive the most attention. (See Dana's Mineralogy, Kopp's Krystallographie, Miller's Mineralogy, etc.) Every crystallizable body invariably assumes its own characteristic form, or some form directly derived from it or related to it by a simple law, and in order to classify them crystallographers recognize at the present time six systems, to one or other of which every crystal is referred. A seventh system is sometimes conceded, but the occurrence of crystals belonging to it has not been demonstrated with certainty.

The following definitions should be well understood: The plane surfaces bounding a crystal are termed *faces;* when two contiguous faces intersect, an *edge* is formed; an *angle* is formed when three or more faces intersect.

The faces, edges, or angles of a perfect crystal have equal faces, edges, or angles opposite to them, and if the middle point of the opposite faces or edges, or the opposite angles, be joined by straight lines, the point at which these lines intersect will be the centre of the crystal. The lines drawn through this point are called *axes*.

When *the same* body crystallizes in two or more forms belonging to different systems, it is said to be *dimorphous*, *trimorphous*, *polymorphous*, etc. When *different* substances crystallize in the same form, they are said to be *isomorphous*.

Prismatic (or prism-like) *crystals* are those which are extended principally in the direction of their longest axis. *Tabular crystals* are those crystallizing in flat plates; *laminar*, those crystallizing in thin plates; *acicular*, those which are needle-shaped, etc.

Other terms are used to describe the physical characters of crystals, which are readily understood and are not technical in their meaning.

The systems of classification are based upon the length and relative position of the axes of the crystal. Those in which the three axes intersect at right angles are termed *orthometric;* and when the angles caused by their intersection are oblique, they are called *clinometric*.

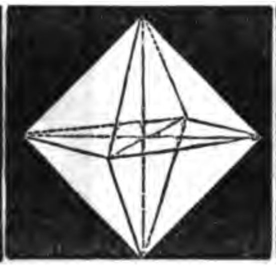
SYSTEMS IN CRYSTALLOGRAPHY.

I. Monometric, or Regular System.—The crystals have three axes of *equal* length intersecting at right angles (see Figs. 286, 287, and 288).

FIG. 286.

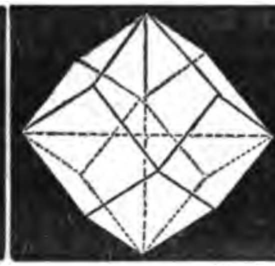
Cube.

FIG. 287.



Octahedron.

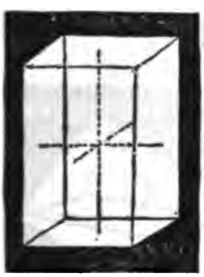
FIG. 288.



Rhombic dodecahedron.

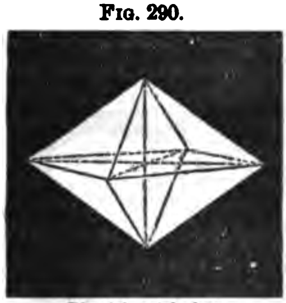
II. Dimetric, or Quadratic System.—The crystals have three axes,

FIG. 289.



Right square prism.

FIG. 290.



Dimetric octahedron.

two of which are *equal*, the other *different* in length, all intersecting at right angles (see Figs. 289 and 290).

III. Trimetric, or Rhombic System.—The crystals have three axes

FIG. 291.

Rhombic pyramid.

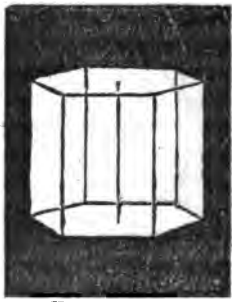
FIG. 292.

Prismatic pyramid.

of *unequal* length, all intersecting at right angles (see Figs. 291 and 292).

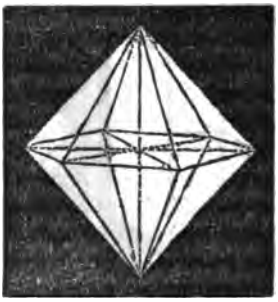
IV. Hexagonal, or Rhombohedric System.—The crystals have four axes, three of *equal* length, in the same plane, and inclined to one another at angles of 60°. The fourth axis is *different* in length, and intersects the plane of the other three at right angles (see Figs. 293 and 294).

FIG. 293.



Hexagonal prism.

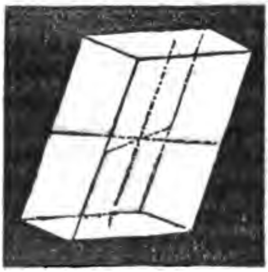
FIG. 294.



Double hexagonal pyramid.

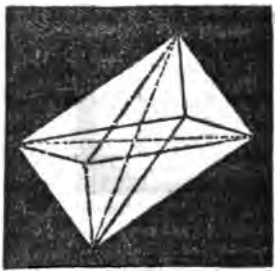
V. Monoclinic, or Oblique-Prismatic System.—The crystals have three axes of *unequal* length, two of which are obliquely inclined to

FIG. 295.



Monoclinic prism.

FIG. 296.



Monoclinic octahedron.

each other, the other axis forming right angles with these two (see Figs. 295 and 296).

VI. Triclinic, or Doubly-Oblique Prismatic System.—The crystals

FIG. 297.

Doubly-oblique prism.

FIG. 298.

Doubly-oblique octahedron.

have three axes of *unequal* length, all obliquely inclined to one another (see Figs. 297 and 298).

The Diclinic System, if recognized, would have three axes, two at right angles to each other, the third oblique to the other two.

Determination of Crystalline Form.—The method of determining the position of a crystal in one or other of the systems above noted is to measure the inclination of the angles which the faces of the crystal make with one another. From the data obtained the length and inclination of the axes are calculated. The hand goniometer or Wollaston's reflecting goniometer is used to measure the angles.

Cleavage.—If a crystal of potassium ferrocyanide or a piece of mica is broken and examined, it will be noticed that the cohesion of the particles is less in one direction than in any other, and if the blade of a knife is inserted in the edge, the crystal may be easily split or cleft. Other crystals possess this property, but to a greatly varying extent. Perfect crystals may sometimes be formed by cleavage.

The Process of Crystallization generally takes place when a body passes from a liquid or a gaseous condition into the solid state: a few instances are known where amorphous solids become crystalline without becoming liquefied, as in iron or brass wire, sulphur, barley-sugar.

Methods of Obtaining Crystals.—1. By fusion and partial cooling. 2. By sublimation. 3. By deposition from supersaturated solutions as they cool. 4. By deposition from solutions during evaporation. 5. By deposition from solutions upon passing through them a galvanic current. 6. By precipitation. 7. By the addition of a substance having a strong affinity for water.

1. **By Fusion and Partial Cooling.**—Substances which have low melting-points, like sulphur, camphor, and iodine, and some of the metals, like bismuth, antimony, etc., may be crystallized in this way. To obtain crystals of a substance like sulphur, it should be melted in a deep vessel and then allowed to cool, so that a crust will be formed; a hole is then made in the crust, and a smaller one on the opposite side; the vessel is now inclined towards the side having the larger hole, and the melted substance runs off; when the surfaces inside are examined, they will be found studded with crystals. If the quantity of material used is large, and the mass has been gradually cooled, the crystals will be large and distinct. The crust should be perforated as soon as it is fairly formed, and the fluid contents quickly removed.

2. **By Sublimation.**—This is one of the most useful methods of obtaining crystals (see Sublimation, page 171).

3. **By Deposition from Supersaturated Solutions.**—This is the method by far most frequently employed to obtain crystals. The solution of the substance is generally effected by the use of heat (see Solution): it should be carefully filtered, and evaporated to the proper degree, and this latter part of the operation is the most important in determining the size and beauty of the crystals. As a rule, concentrated solutions produce small, ill-defined crystals, whilst comparatively dilute solutions, provided they are supersaturated, produce crystals of more perfect form. The proper degree of concentration must always depend upon the solubility of the substance: if very soluble, the solution should not be saturated at the boiling temperature, or the crystals will be very small and so thoroughly interlaced that it will be difficult to wash them; if a por-

tion of the evaporating solution is transferred to a glass or porcelain plate and allowed to cool, the rapidity with which the small quantity of solution crystallizes, and the amount of crystals obtained, form a basis for judgment. Upon the large scale, in order to secure a uniform product, it will be found that the specific gravity of the solution at a definite temperature, the temperature of the air, and the quantity of the solution must be considered: these points, however, can be obtained only by experience, and after a practical trial with each substance. It is a good habit to keep a record at each operation of the specific gravity and temperature of the solution which is set aside to crystallize, and note the character of the product. If the substance is not very soluble, the solution should be evaporated until a *pellicle* or crust is formed upon the top, and then set aside.

Perfect Rest for a solution designed for crystallization must be secured, if well-defined crystals are wanted, and the solution must not be cooled quickly. When small crystals are desired, as in the case of magnesium and zinc sulphate, the solution should be cooled quickly, with constant agitation: this produces a great many nuclei, and prevents the gradual deposition of the particles in regular order upon one nucleus, which is so essential to the formation of the perfect crystal. There are several plans to choose from, for preventing rapid cooling: if the liquid is placed in an evaporating dish, and heated in a sand-bath or water-bath until evaporated to the proper point, the whole may be set away without disturbing them, to cool slowly together; or the dish may be placed in a warm room which is slowly cooled; or it may be embedded in a blanket or in woollen cloths, covered, and set aside. Having arranged the dish, it must be left absolutely undisturbed until all the crystals have separated: if jarred or knocked after the crust has once formed, the crystals will be mere confused masses.

Use of Nuclei.—It has long been known that if a smooth glass rod having a single scratch upon it be placed in a solution ready to crystallize, crystals will first attach themselves to the scratched part, and the smooth part of the rod will frequently not have any separate crystals upon it. Rough surfaces, by offering more points of adhesion, attract the nuclei upon which the crystalline body is subsequently deposited: it is for this reason that strips of wood or lead are frequently suspended in liquids intended for crystallization, whilst in the manufacture of rock-candy, threads are usually strung across the crystallizing-tubs at regular intervals, columnar masses of fine crystals being thus produced. Perfect geometrical crystals may be obtained by the practice of "nursing," which consists in selecting from the ordinary stock as perfect a crystal as can be found for the nucleus, and then suspending it by a horse-hair or piece of sewing-silk in a warm saturated solution of the salt. Prof. J. U. Lloyd contributed to New Remedies, in 1879, pp. 98, 133, 162, some interesting notes on the production of perfect crystals.

Retarded Crystallization.—Warm saturated solutions of various salts, particularly if contained in chemically clean vessels, protected from the dust, and left at absolute rest until cooled, usually fail to crystallize. If the receptacle is shaken or jarred, or if a crystal from which the solution has been made, or any other solid substance, is dropped into it, crystal-

lization sometimes takes place in an instant, and considerable heat is evolved: this is particularly noticed with salts capable of crystallizing with more than one molecule of water, as sodium sulphate, sodium carbonate, etc.

4. **By Deposition from Solutions during Evaporation.**—This process is not so frequently resorted to as that of cooling from hot saturated solutions, but it is especially useful where the liquid is more volatile than water, as alcohol, ether, benzin, chloroform, and upon the small scale for experimental purposes, or in the processes of original investigation. There are some instances in manufacturing pharmacy where the method is used, but in the case of volatile liquids the expense attending their loss, if spontaneously evaporated, is great, and, as a usual thing, rapid evaporation or recovery of the solvent by distillation cannot be used where large and distinct crystals are desired. Beautiful crystals are often made from aqueous solutions of substances that are allowed to evaporate slowly in a warm room for several months. The quantity of liquid and the amount of solid in solution have a great influence in enhancing the beauty of the product: for this reason it is usually impossible for the pharmacist operating on the small scale to vie with the manufacturer in producing massive crystals; there is compensation, however, to the pharmacist in obtaining increased knowledge of the properties of medicinal chemicals and absolute knowledge of their purity.

5. **By Deposition from Solutions upon passing Feeble Electrical Currents through them.**—This method is mentioned in this connection because Becquerel and others have produced crystals of metals and metallic oxides by the slow but continuous action of feeble electrical currents through the solutions, kept up for months, sometimes for years. Gold and copper may be beautifully crystallized in this way.

6. **By Precipitation.**—Crystals are produced in some cases by the precipitation resulting from the mixture of certain solutions, and in other ways. (See Precipitation.) The crystals formed by this method are granular, and, on account of their rapid growth, are not well defined. A crystalline precipitate of acid potassium tartrate is produced when solution of potassa is added to a strong solution of tartaric acid.

7. **By the Addition of a Substance having a Strong Affinity for the Liquids of the Solution.**—This method of effecting the crystallization of a solid is resorted to in some special cases. If calcium chloride is added to an aqueous solution of sodium chloride, the latter crystallizes out. Alcohol mixed with a solution of potassium nitrate causes the crystallization of the salt, because alcohol and water unite, and the potassium nitrate is not soluble in the mixture. The crystallization of sugar is frequently observed in syrups to which alcohol in the form of a tincture or fluid extract has been added, and this is often a source of annoyance to the pharmacist.

Water of Crystallization.—Many substances in the act of crystallizing combine with water, and the water so combined is termed *water of crystallization.* The same substance does not always contain the same number of molecules of water of crystallization. Sodium carbonate, for instance, usually contains ten molecules. At higher tempera-

tures it may be made to crystallize with eight or with but five molecules, and under some circumstances it contains but one molecule of water. This combination with water must be carefully distinguished from the mechanical retention of water in the interstices of crystals, which takes place particularly where the crystals are large and have been formed rapidly. Water retained in this way is termed *interstitial water*, or *water of decrepitation*, because it is the cause of the *decrepitation* of bodies when exposed to heat: the sudden expansion of the water causes the substance to crackle and burst into fragments. Crystals containing combined water lose part of it on exposure to the atmosphere, and the transparency noticed when the crystal was fresh is replaced by opacity and the formation of a dry powder on the surface. This change is termed *efflorescence*. There are very few substances which will part with all their water of crystallization at ordinary temperatures, nearly all requiring a high heat to effect the object. The act of driving off the water and reducing the crystals to the form of a dry powder is called *exsiccation*. Some substances absorb water from the atmosphere, and, instead of becoming dry, grow moist, and in some cases are converted entirely into liquids. Such substances are said to be *hygroscopic*, and the act is termed *deliquescence*. A good example is found in potassium carbonate which has been exposed to moist air.

Mother-liquor.—The liquid remaining after the crystals have formed is called *mother-liquor*, and still contains some of the salt in solution. This liquid retains as much of the solid as the solubility of the latter and the temperature will permit. It may be evaporated, and another crop of crystals obtained, if desired. Where two salts are in solution, it is obvious that the more soluble salt must exist in largest proportion in the mother-liquor: hence salts are frequently separated from each other by taking advantage of their difference in solubility: thus cinchonine is separated from quinine. The process is termed *fractional crystallization*.

Crystallizing Vessels should be deep, and made of rough-glazed stone-ware or porcelain. On the large scale, wooden tanks or vats are employed. In the crystallization of alum the staves of the vats are retained in place by iron hoops, which may be tightened or loosened by screw-bolts. After the solid crust of alum is formed around the sides and bottom, the hoops are loosened, the staves removed, and a hole chiselled through the side crust near the bottom, to permit the mother-water to escape.

Collection, Draining, Washing, and Drying of Crystals.—Upon the small scale it is usually sufficient, after the mother-water is decanted, to break the crust of crystals, and, having placed a few pieces of clean broken glass in the throat of the funnel, to place the crystals upon them and drain thoroughly. They are then to be washed by pouring water carefully and sparingly upon them. If the crystals are very soluble in water, and it is necessary to free them entirely from mother-liquor, they must either be washed with alcohol or some liquid in which they are not so soluble, or with ice-cold water, used very carefully but quickly by pouring it drop by drop upon the crystals, so that the smallest quantity will suffice. After draining, they may be transferred to a double

sheet of filtering-paper, placed on a bed of two or three newspapers or cloths, loosely covered, and removed to a dry atmosphere. If the crystals are liable to effloresce, they should be turned several times, and bottled as soon as fairly dry. Deliquescent crystals, like those of chromic acid, may be dried by spreading them on a clean brick in a dry room. The mother-water will be gradually absorbed by the brick, and as soon as the crystals are dry they are transferred to a close vessel.

Intermediate Crystallization is a term used to define the process of crystallizing a substance which is comparatively insoluble in simple solvents, by causing it to dissolve in a hot solution of another substance. Of course the latter should be very soluble: the whole of the ordinarily insoluble salt will entirely crystallize out at the first attempt. Mercuric iodide may be made to crystallize in this way in brilliant scarlet crystals by dissolving it in a hot solution of sodium chloride, potassium iodide, or mercuric nitrate.

QUESTIONS ON CHAPTER XV.

CRYSTALLIZATION.

What is crystallization?

What are non-crystallizable substances called?

In the classification of crystals, how many systems are recognized?

What is meant by the centre of a crystal?

What is meant by the axes of a crystal?

What are substances called that crystallize in two forms? In three forms? In more than three forms?

What are prismatic crystals? Tabular crystals? Laminar crystals? Acicular crystals?

Upon what are the systems of classification of crystals based?

What are those called in which the three axes intersect at right angles?

What are those called in which the angles caused by the intersection are oblique?

Describe the monometric, or regular system. The dimetric, or quadratic system. The trimetric, or rhombic system. The hexagonal, or rhombohedric system. The monoclinic, or oblique-prismatic system. The triclinic, or doubly-oblique prismatic system. The diclinic system.

How can the form of a crystal be determined, as to which system it belongs?

What is the instrument for measuring the angles of crystals called?

What is meant by cleavage?

Under what circumstances does the process of crystallization generally take place?

Do solids ever become crystallized without becoming liquefied?

Give an example.

By what various methods may crystals be obtained?

How may crystals be formed by fusion?

Do weak or strong solutions form crystals of the most perfect form?

How may large crystals be obtained?

How may small crystals be obtained?

Are crystals more readily deposited on rough or smooth surfaces?

How may perfect geometrical crystals be produced?

In what cases is the process of obtaining crystals by evaporation useful?

How may gold and copper be crystallized?

Give an example of the production of crystals by precipitation.

Also when two solutions are mixed together.
Why does the addition of alcohol to syrup cause the sugar to crystallize?
What is water of crystallization?
What is interstitial water?
What is water of decrepitation, and why is it so called?
What is efflorescence?
What is exsiccation?
What substances are hygroscopic?
What is deliquescence?
Give an example of a deliquescent salt.
What is mother-liquor?
What is meant by fractional crystallization?
How should crystallizing vessels be made?
How is alum usually crystallized?
On the small scale, how may crystals be obtained?
What is meant by intermediate crystallization?

CHAPTER XVI.

GRANULATION AND EXSICCATION.

By granulation is meant the process of heating the solution of a chemical substance, with constant stirring, until the moisture has evaporated, and a sabulous, coarse-grained powder is produced. It is a convenient method of obtaining many substances in the form of powder: indeed, the practical advantages of granulated powders are so well recognized now at the prescription-counter, that their use in preference to large crystals is rapidly extending. This is particularly the case with salts which are not very soluble in water, or which are commonly found in commerce in hard, tough, crystalline lumps or masses. The process of granulation is one which requires care, but no great amount of skill. The solution of the substance is generally evaporated rapidly until a pellicle forms upon the surface. Then the heat is moderated, in order to prevent spurting and caking: great care must be exercised at this stage of the process to stir the mass constantly, as the tendency to form a crust on the bottom is very great, and when this hard crust is broken up by the stirrer it is very difficult to avoid the formation of lumps; but if the crust is not allowed to form, by keeping the bottom of the dish clean through constant stirring, the salt will separate in distinct grains, which will not adhere to each other. Towards the end of the process the heat should be very moderate, and the product should be introduced at once into a clean, warm, dry bottle.

Granulated Effervescent Salts are made by mixing the dry powders with dry tartaric acid and sodium bicarbonate and moistening the mixture with strong alcohol. The pasty mass is passed through a sieve, and the granules dried quickly in a hot room, sifted, and filled into bottles, which must be hermetically sealed to prevent the access of moist air.

Exsiccation is the process of depriving a solid crystalline substance of its water of crystallization or moisture by heating it strongly.

The product is usually a fine powder, and the original crystalline condition of the substance may be restored by redissolving it and evaporating the solution. The process is conducted by exposing the crystals to the air or a warm temperature until they are effloresced, and then gradually heating, with stirring, until they cease to lose weight; the residue is then powdered and kept in well-stopped bottles. The object of exsiccation is to increase the strength of substances and thereby fit them for special applications. For instance, exsiccated sulphate of iron is preferred as an ingredient in pills, because sixty grains contain as much ferrous sulphate as one hundred grains of crystallized ferrous sulphate, and the pills can therefore be made one-third smaller. The mass is also much more readily formed from the finely-powdered exsiccated salt.

CHAPTER XVII.

DIALYSIS.

Dialysis is the process of separating crystallizable substances from those which do not crystallize, by placing a mixture of their solutions upon a porous diaphragm which has its under surface in contact with water. This remarkable process was discovered by Graham in 1861. He termed the substances which had the power of passing through the septum or diaphragm *crystalloids*, because they always have the crystalline form, and those which remained upon the diaphragm *colloids*, from their resemblance to gelatin and because they never crystallize. He also pointed out the differences between the two classes. Crystalline bodies, or crystalloids, are diffusible, brittle, hard, with clearly-defined angles and flat faces: their solutions are free from viscosity, and their reactions energetic and quickly effected. (Example, sugar.) Colloidal bodies, on the other hand, are not diffusible: they are tough, with more or less softness of texture. The mathematically-arranged angles and faces of crystals are replaced in colloids by rounded, irregular outlines, the fracture often being curved or conchoidal. Water of crystallization is replaced by water of gelatination, and the solution of colloids is, when concentrated, viscous or gummy, and their reactions are sluggish or inert. (Examples, gum, glue, starch, dextrin, gelatin, albumen, extractive matter.)

A thin layer of gelatin interposed between two liquids offers no obstacle to the passage of the crystalloids from one to the other, while it completely prevents the passage of the colloids: this property belongs not only to gelatin, but to other substances having a similar molecular constitution, as bladder, parchment, etc., of which the most convenient is the texture known as *parchment-paper*, prepared by immersing unsized paper in a *cold* mixture of two measures of sulphuric acid and one of water, and subsequently washing it thoroughly to free it from acid.

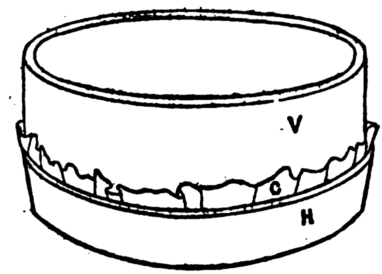
Upon the principles stated above Prof. Graham contrived a very simple apparatus which he called the dialyzer (see Fig. 299). It consists of two parts, one a circular glass recipient (*b*), about a foot in diameter and six inches deep, the other (*a*) a similar circular vessel, from six to ten inches in diameter and about two inches deep, the circumference of which consists of a band of gutta-percha and the bottom of a circular piece of parchment-paper, the edges of which are brought over the lower rim of the gutta-percha band nearly to the top, and fastened outside of it by a string or by a narrow hoop of gutta-percha. The first part, or circular basin, is to receive distilled water, and should contain from five to ten times the quantity of the liquid that may be introduced into the smaller vessel. The latter is to float upon the surface of the water in the former, and is to receive the liquid to be submitted to dialysis, which should not

be more than half an inch deep on the paper bottom. It is important that the parchment-paper employed should have no rent or aperture, and should be brought well up and secured on the outside of the gutta-percha to prevent the liquid from passing between them. If any liquid containing a mixture of colloid and crystalloid matter be placed in the floating vessel, after some hours it will be found that a portion of the latter has passed through the parchment-paper, and is held in solution

Fig. 299.

Dialyzer.

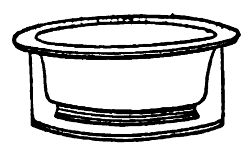
Fig. 300.



Dialyzer.

by the distilled water of the larger vessel, while the colloid matter remains. The distilled water thus impregnated is called the *diffusate*. The parchment-paper, or any similar material used as the septum, is applicable to the dialysis of substances held in watery solution only, and will not answer for alcoholic or ethereal liquids. The hard-rubber sieve, which has been already noticed (see Fig. 300), makes an excellent dialyzer if floated upon pure water in an evaporating dish or beaker. Fig. 301 shows another form, in which the glass dialyzer has its upper edge expanded into a flat shoulder, which rests upon the upper edge of the round dish[1] containing the water. This has the advantage of keeping the diffusate covered whilst the dialysis is progressing. It is obvious that very different arrangements might be made to accomplish the same ends. Thus, a bladder three-fourths filled with a mixture, suspended in a jar of distilled water, would yield similar results. Graham's apparatus is preferable to others only for its convenience.

Fig. 301.



Dialyzer.

The following applications of the process of dialysis have been made: 1. It facilitates in many instances to a considerable extent the separation of the active matter of any artificial or natural mixture from the inert and useless, the former being very often crystalline and the latter colloidal. Thus, infusions or decoctions of medicines, such as opium, belladonna, aconite, etc., submitted to dialysis might give up more or less completely their crystalline principles, such as the salts of morphine, atropine, aconitine, etc., to the water, while the gummy, resinoid, extractive, and coloring matters, etc., might remain behind. In effecting

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[1] This vessel is sometimes called the "exarysator."

the analysis of organic bodies, one of the most embarrassing problems is to get rid of the inert principles which interfere with the action of chemical reagents, and the process of dialysis may here often be brought to the aid of the operator. 2. In searching for poisons in organic mixtures, as in the contents of the stomach, in which the application of tests is often rendered abortive by the colloidal matter present, the problem of the presence of the poison may sometimes be solved by submitting the suspected matter to dialysis. The poison will often be found in the diffusate separated from the other matters, and may then be detected by the ordinary tests. 3. In pharmaceutical operations it often happens that salts and other crystallizable substances are thrown away as refuse matter because they would not repay the cost of time and material necessary for their recovery. It is possible that by this simple, inexpensive process these substances may be separated from the useless matters and thus saved. 4. An economical application has been made of the process to the restoration of salted meat to the fresh state. If some salt beef with its brine be enclosed in a bag of material suitable for dialysis, as of untanned leather, and the bag be immersed in sea-water, in the course of some days the beef and brine will have been rendered sufficiently fresh for use, the salt having passed out into the sea-water. B. F. McIntyre, of New York, gave a great deal of attention to the practical applications of dialysis, and introduced a class of preparations called *Dialysates.* These were prepared from various drugs by dialysis, and it was claimed that they contained the active crystallizable constituents in their original combination, deprived of inert colloidal substances.

Dialyzed iron, or *Ferrum Dialysatum*, is a colloidal preparation made by placing a mixture of basic ferric chloride and ammonium chloride upon a septum: the crystalloids (ammonium chloride and ferric chloride), with any free acid, pass into the diffusate, leaving the neutral colloidal liquids upon the septum.

QUESTIONS ON CHAPTERS XVI. AND XVII.

GRANULATION, EXSICCATION, AND DIALYSIS.

What is meant by granulation?
How are granulated effervescent salts prepared?
What is exsiccation, and what is its object?
What is dialysis?
What are crystalloids? Give an example.
What are colloids? Give examples.
What is the most convenient substance to use for a dialyzing medium?
How is it prepared?
Describe Professor Graham's dialyzer.
What is the liquid called in which crystalloid matter is dissolved, which has been passed through a dialyzer?
What applications of the process of dialysis have been made?
What preparations have been called dialysates?
What is dialyzed iron?

CHAPTER XVIII.

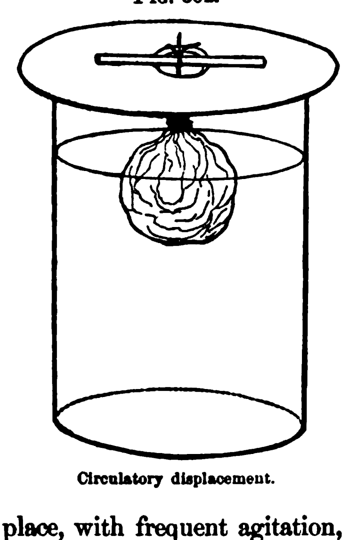
EXTRACTION.

UNDER this head are included those operations which have for their object the separation of the soluble principles from drugs by treating them with a liquid capable of dissolving them, which is called the *menstruum*. Extraction differs from solution in the fact that the presence of insoluble matter is implied in the former, and the soluble constituents must therefore be *extracted* or separated, by appropriate methods, from those which are insoluble. The principal modes of extraction employed in pharmacy at present are as follows: 1. Maceration and expression. 2. Percolation. 3. Digestion. 4. Infusion. 5. Decoction. Maceration and expression are old processes, and they will be considered first; percolation is much more important and useful, and will be treated of in a separate chapter; digestion is merely a modified form of maceration. Infusion and decoction are processes which are used in producing separate classes of official preparations: hence they will be considered in Part II.

MACERATION.

The process of *maceration*, which is of ancient origin, consists simply in soaking the properly comminuted drug or substance in the menstruum until it is thoroughly penetrated and the soluble portions softened and dissolved. The usual method is to introduce the drug or substance into a bottle with the menstruum, cork it tightly, and agitate it occasionally for a period ranging from two to fourteen days; then to pour off the liquid, express the residue to avoid waste, and filter the mixed liquids. An advantage is sometimes gained by suspending the ground drug, tied in a bag, in the upper part of the menstruum (see Fig. 302): this is sometimes termed *circulatory displacement*. Maceration is the process directed by the German Pharmacopœia exclusively in preparing tinctures: the drugs are ordered in all cases to be macerated in definite weights of alcohol for a week in a closed bottle, in a shady place, with frequent agitation, at a temperature of about 15° C. The liquid is then separated by strain-

FIG. 302.



Circulatory displacement.

ing or expressing from the insoluble residue, and, after having been allowed to settle, it is filtered. Evaporation during filtration is to be avoided as much as possible. Maceration has no advantages over percolation in making the greater number of liquid preparations from drugs, except in the hands of the careless or unskilful. If an operator possesses no knowledge whatever of the process of percolation, it is safer to trust to maceration, for here no particular skill or judgment is necessary; the soaking process is completed in due time, and the separation of the absorbed liquid, whilst laborious and uncleanly, has at least the merit of leaving the tincture uniform in strength; if the process of expression is not thoroughly performed, pecuniary loss results, but the finished preparation is uniform. On the other hand, in percolation, if the operator has, through careless packing, failed to exhaust thoroughly the drug with the amount of menstruum used, a portion of the activity of the drug remains in the residue, which is thrown out, and the preparation is thus deficient in strength. In making tinctures by maceration, the practice of weighing liquids, as directed in the German Pharmacopœias, is seen to the best advantage, although, of course, the principal objection to preparations made from weighed liquids still exists,—the necessity for a calculation to determine the dose as compared with that of the drug. The tincture must always be administered by measure, and hence a teaspoonful or a fluidrachm should bear a certain relation to the drug, which is readily ascertained without resorting to a problem in specific gravity.

Digestion is that form of maceration which consists in the application of a gentle heat to the substance which is being treated. It is used in those cases where a moderately elevated temperature is unobjectionable, the heat increasing the solvent powers of the menstruum.

QUESTIONS ON CHAPTER XVIII.

MACERATION.

What is meant by extraction?
What is meant by menstruum?
What are the principal modes of extraction employed in pharmacy?
What is meant by maceration?
What is meant by circulatory displacement?
How are all tinctures directed to be prepared by the German Pharmacopœia?
Which is the better process in unskilled hands, maceration or percolation, and why?
What is the principal objection to preparations made from weighed instead of measured liquids?
Define digestion.

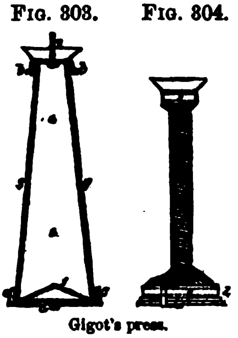
CHAPTER XIX.

EXPRESSION.

EXPRESSION is the process of *forcibly* separating liquids from solids. It is generally effected by the use of a press, although for many pharmaceutical operations, upon the small scale, the use of straining-cloths with hand-pressure suffices. Pressing-cloths are generally employed, but they are troublesome, and of late years strong efforts have been made to construct presses which could be used without them. At least six mechanical principles are recognized in the operation of expression as now practised: namely, by the use of—1. The spiral twist press. 2. The screw press. 3. The roller press. 4. The wedge press. 5. The lever press. 6. The hydraulic press.

1. **The Spiral Twist Press.**—The principle of this press is best and most practically illustrated in the usual process of expressing a substance contained in a cloth with the hands. The mixture to be expressed is placed in a bag or a cloth held in one hand by the four corners, which are gathered together, and the lower portion, or bag, is rotated with the other hand, so that, beginning at the top, the point of smallest diameter, the strainer is spirally twisted, the pressure forcing the liquid between the meshes of the cloth. Figs. 303 and 304 show Gigot's press, in which this principle is used upon a larger scale. Upon the left hand is shown a sectional view of the press as it appears when filled with material. The perforated cone, *d*, forms the bottom of a conical strong cloth tube; the upper end is connected with a funnel, *l*, which is so constructed that none of the material that has passed down into the bag can leak back. The lower portion of the cloth is secured to a ring, which may be fastened, so that it will not rotate when the press is used. If the upper end of the cloth is twisted, the space occupied by the material is contracted, and the liquid oozes through the meshes of the cloth. The dry residue is discharged by untwisting the cloth and unhinging the bottom, which opens downwards.

FIG. 303. FIG. 304.



Gigot's press.

2. **The Screw Press** is the most useful of all forms for pharmaceutical work where very great power is not desired. The screw is always used in combination with one or more levers, and this form of press is employed in great variety to accomplish special purposes. There are two forms of screw presses: 1. Single-screw presses. 2. Double-screw presses. Each of these forms may be subdivided into

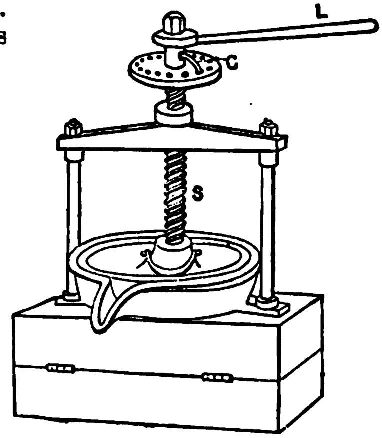
those in which the position of the screw or screws is *vertical*, and those in which the position of the screw or screws is *horizontal*.

1. *Single-Screw Presses.*—In this form of press the single screw is generally used in a vertical position, and operated with a lever or a combination of levers. It is the simplest kind of press, and if well made will admirably answer the general purposes of the pharmacist. The screw should have a square-faced thread, and be well made. The plunger should be disconnected from the end of the screw, or else move freely around it. The parts of the press which come in direct contact with the material to be pressed should be coated with tin or porcelain, so that liquids containing acid or tannin shall not be affected injuriously. Fig. 305 shows a press of this description, made by H. Troemner, of Philadelphia. A perforated tin case accompanies the press. This may be used when pressing bulky drugs, like arnica flowers, and press-cloths may be abandoned. The best material for press-cloths

FIG. 305.

Troemner's press.

FIG. 306.

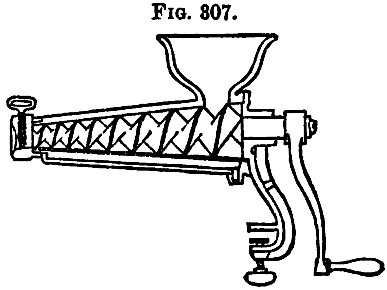


German single-screw press.

is that which is especially made for the purpose. It is twilled and elastic in one direction, and, if proper care be taken when enveloping the material and introducing it into the press, the same cloth may be used many times, as the pressure causes the meshes to open without breaking the threads. The manufacturers of linseed oil use press-cloth largely. For small operations, in the absence of press-cloth, which is very expensive, new Russia crash may be used. The press-cloth should be moistened, if possible, with some of the same liquid expressed at a previous operation. Water answers very well if the liquid is aqueous. The substance to be pressed is laid upon the cloth, and one corner of the cloth laid over it. The opposite corner is then placed upon the first; next one of the remaining corners is laid in the same way upon the first two, followed by its opposite. The corners should be folded over so that a square, somewhat flat package is produced, in size somewhat smaller than the press-plate, especial care being observed to suit the quantity of material to the capacity of the press. If too much is taken, the press-cloth will be too small to permit of folding it over sufficiently; the corners

of the package will therefore not withstand the pressure, portions of the material itself will ooze out, and the whole operation must be repeated. The principal objection to the single-screw press is, that unless the material in the press is nearly homogeneous, so that the press-cake is equally pressed upon at all points, unequal action results, the press-block is pressed against one side of the case, causing violent friction and and resistance, and the thread of the screw binds upon one side, full pressure thus being defeated; whilst the main objection to the vertical screw is, that the press-block and plate must be in a horizontal position, so that the liquid pressed out adheres to the cloth, and cannot be collected readily without tilting the press. Fig. 306 is an illustration of a German single-screw press which is well adapted for pressing the residues from macerated tinctures. The large lip of the containing vessel is a practical convenience, whilst the lever, L, in combination with the catch, C, gives unusual power and ease in working, for a small press. In the horizontal screw press, the jaws being vertical, there can be no obstruction to the dropping of the expressed liquid, which may be caught in a vessel placed immediately under it. Oberdoffer, of Hamburg, Germany, makes a very powerful horizontal screw and compound lever press. Fig. 307 illustrates a novel horizontal screw press, made by the Enterprise Manufacturing Company, of Philadelphia, which is operated without a press-cloth. It consists essentially of a tapering cylinder, with a hopper on the upper side at its large end, and a strong screw fitting closely to the inner surface of the case, the thread of which diminishes in size as the screw becomes smaller. Along the under side of the cylinder is formed a channel adapted to receive a perforated brass plate. This latter has a transverse concavity corresponding to that of the inner surface of the cylinder, and the perforations allow the escape of the expressed fluids into the channel or gutter beneath, from which it escapes by a proper outlet. The substance to be expressed is placed in the hopper, and, the crank attached to the screw being turned in the proper direction, the thread of the screw compresses the substance into a smaller and smaller space, until finally it is discharged at the farther end of the cylinder in a comparatively dry state. A large screw, passing through a removable end of the conical cylinder, regulates the size of the outlet, and serves to increase or diminish the amount of pressure to which the mass is subjected by the screw. The brass plate in the bottom of the machine can be replaced by others having perforations of different sizes. Clogging of the holes by bits of wood, stems, or seeds is prevented by the shear-like action of the edge of the screw-thread, which shaves off the protruding fragment, while the rest is forced through the perforation. To increase the power of the press upon slippery substances, the inside of the casing has a few longitudinal

FIG. 307.



Enterprise press.

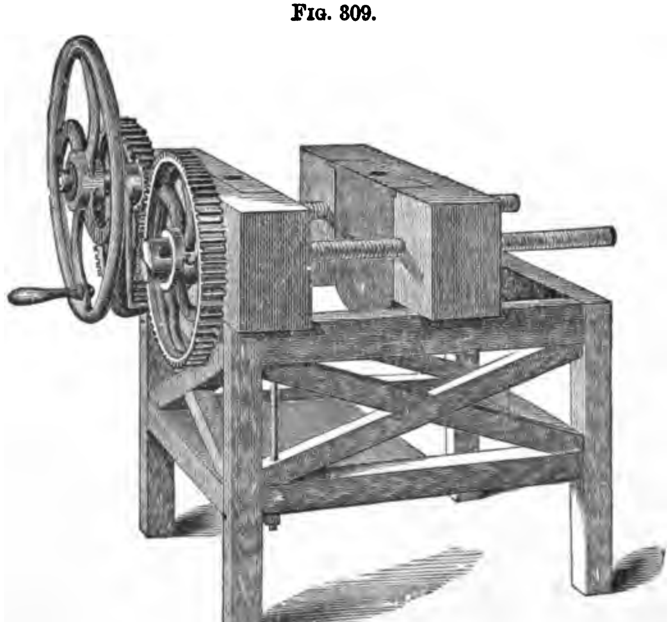
or spiral grooves at a greater or less angle to the direction of the screw-thread. Arrangements are provided for detaching the casing from the screw, and for attaching the whole to the edge of a table or bench. Fig. 308 shows the press as taken apart.

FIG. 308.

Enterprise press.

2. *Double-Screw Presses* are preferred by many. These are always of the horizontal screw form, and in Fig. 309 is shown one made as proposed by Chas. T. George, of Harrisburg, Pa. A strong and substantial framework, made of ash wood, forms the base. Two pieces of timber rest upon this frame, one firmly attached by an

FIG. 309.



George's double screw press.

iron rod and keepers to one end of the frame or table, and the other free or movable, both blocks being bored at the same distance from the end with smooth holes to receive the two iron screws.

Upon the movable block, and opposite the holes, a female nut of bell-metal is firmly fixed. Upon the inner face of the two timber blocks, iron castings, saddle-shaped and hollow, are inserted, flush with the face of the block, each capable of holding six pints of boiling water, and each casting having a hole on top to receive hot water or steam: a brass pet-cock is fixed at the bottom to discharge the chilled water.

The two iron screws pass through the holes of both blocks of timber, the head of each screw having an iron cog-wheel attached to it; into the cogs of each wheel a pinion-wheel is firmly fixed, which in turn is fastened to a short shaft having at its end an iron fly-wheel.

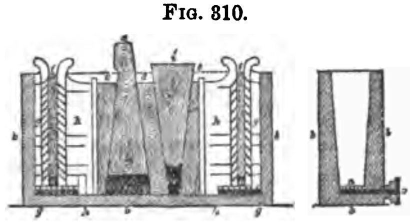
By turning this wheel both screws are evenly and rapidly rotated without danger of bending or breaking, and consequently one block is drawn surely and with great power against the other, thus expressing whatever drug may be placed in a sack of strong linen towelling between the two blocks of timber.

It is apparent that the double-screw press is very powerful, and, the pressure being equalized, good results are obtained.

3. *The Roller Press* is used upon the large scale for pressing oily seeds, fatty substances, etc. Its principle is thoroughly shown in the well-known clothes-wringer, which, although made for the laundry, serves as a very efficient press for many substances. Care must be taken to apply the force gradually to the bag containing the berries or other material to be pressed, and not to use it upon substances which will soften or dissolve the rubber rollers.

4. *The Wedge Press.*—This form of press is powerful, economical, and inexpensive. It is objectionable principally on account of the noise necessarily made in driving the wedges. Fig. 310, taken from Knapp's Technology, illustrates the wedge press. The filled cloths are laid between strong plates, *h* and *g*, and placed in a square space cut in a solid block of oak wood or in a cast-iron case, *b*, and the plates are forced nearer and nearer to each other by driving in the wooden wedges which occupy the remaining space. One of these wedges, *a*, serves to facilitate the disconnection of the apparatus; the strokes which drive in the wedge *i* tending, from the reverse position of *a*, to drive the latter out; *c*, *e*, and *d* are intermediate pieces to prevent the wedges from coming into immediate contact. The pressing-plates are each provided with three side ribs: the immovable ones, *g*, *g*, press against the sides of the case, and the movable ones, *h*, *h*, against the intermediate wedges, *c*, *e*, and are pierced with numerous holes to allow the liquid to flow out more easily. On filling the press, the wedge *a* must be suspended (by a string) at a distance from the bottom, so that the apparatus may be easily taken to pieces. The liquid trickles from the pressing-plates through the pierced horizontal plates, *n*, *n*, upon which these rest, into the pipe *o*. Both *a* and *i* are driven by separate stampers, which are raised by a toothed wheel, or mallets may be used.

FIG. 310.

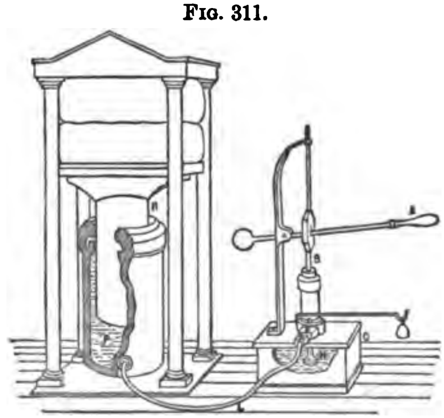


Wedge press.

5. *The Lever Press.*—The only advantages possessed by this press over those previously noticed are its cheapness, and that it may be made by any one possessed of even moderate mechanical abilities. Prof. Procter recommended the following method of construction. "A piece of timber twelve feet long, and with lateral dimensions sufficiently great to be inflexible with the force to be applied to it, has one of its ends securely attached to a wall or upright post in such a manner as to admit of the motion of the other end. The pressing-box being placed about one foot from the fixed end, on a firm block of wood, is subjected to the action of the lever by placing a piece of wood vertically between the piston-block of the pressing-box and the lever. It is obvious that a weight of one hundred pounds at the opposite end causes a downward pressure equal to eleven hundred pounds at the box. The pressing-box most usually employed is a cylinder, closed at one end, made of thick tinned-iron, secured with bands of the same material, which are soldered on, and between these, numerous holes are perforated. This cylinder is set in a tin dish with a lateral spout. The piston-block is constructed of hard oak wood with the grain running transversely to its axis." The objection to this press is that, compared with other presses, it yields but little power in proportion to the space occupied; but as an offset to this it can be made to work simply and quickly.

6. *The Hydrostatic or Hydraulic Press.*—Of the presses heretofore mentioned, each has some especial advantage or use, but each has also some fault or objectionable feature. The spiral twist is not powerful, and its action is limited. The screw presses of both varieties have friction to contend with. The friction of a screw increases with the intensity of the pressure applied, and when a certain limit is reached all further force applied is wasted, and, if persisted in, involves the destruction of the press. The roller press is very limited in its action; the lever press is unwieldy and not powerful; the wedge press is noisy and can be used only for special purposes. The hydrostatic press is costly, but after the first cost it is the most economical, because the greatest power is obtained at the expense of the least labor. The principle is shown in Fig. 311. It must be remembered that the molecules of fluids move freely in contact with one another almost without friction, and, according to Pascal's law, "Pressure exerted anywhere upon a mass of liquid is transmitted undiminished in all directions, and acts with the same force on all equal surfaces and in a direction at right angles to those surfaces."

Fig. 311.

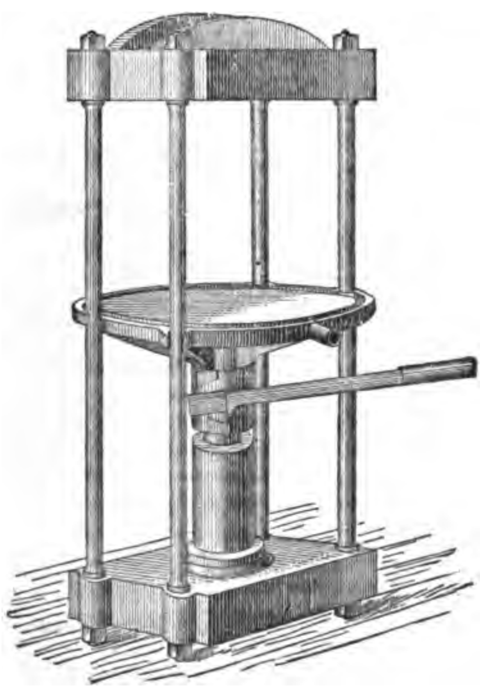


Hydraulic press.

Although it has been proved that liquids are to a slight extent compressible, it has also been shown that they are *perfectly elastic:* so that

if a plug be forced intó a liquid which entirely fills a vessel, the pressure is felt equally upon every square inch of the surface of the vessel and upon every square inch of the surface of any body immersed in the liquid, and if the pressure is removed from the plug it will be immediately forced out of the vessel and the liquid will at once regain its original volume. Now, if a vessel is constructed having two columns communicating at the bottom, as in Fig. 311, and if water or other fluid is placed in it, it will be found that a pressure of one pound applied at the piston in the tube, B, will be communicated to every portion of the lower surface of the ram, R. If the area of R is ten times greater than that of B, it follows that a pressure of one hundred pounds on A, conveyed through the lever, exerts an upward pressure of one thousand pounds on R. By increasing the area of the ram the power may be greatly multiplied, so that pressure applied by one man on the lever may be communicated to the liquid and made to exert an upward pressure of several tons. Fig. 312 shows a pharmaceutical press made by R. Dudgeon, of New York, constructed on the principle of hydrostatic pressure. In order to economize space, by an ingenious system of valves one of the cylinders is contained within the other, and by pumping the oil into the outer vessel the ram carrying the platen is forced upward. The platen has a groove around its edge communicating with a spout for carrying off the expressed liquid. Press-cloths may be used to contain the material to be pressed, or a very strong perforated case is supplied. The upper plate is very strongly secured by bolts and nuts, and press-blocks covered with tinned iron are employed to fit into the perforated case if desired. The weight of one man, one hundred and fifty pounds, applied to the end of the lever will produce an upward pressure equivalent to ten tons. This is the most powerful press available for pharmaceutical purposes, and, although expensive, its first cost will be more than offset by its durability and by its economy of power whenever pressure greater than that afforded by the smaller presses is needed.

FIG. 312.



Dudgeon's press.

The following maxims should be observed in operating presses:

1. All moving parts of the press should be well lubricated before attempting expression.

2. Pressure should be *gradually* increased; sudden strains should always be avoided. If this precaution is neglected, either the press-cloth or press-bag will burst, the finer solid particles will be forced through the meshes, or breakage of press-plates or press will result.

3. Pressure, to secure the best results, should be unrelaxed, but intermittent. After apparently reaching the limit of compression, the action of the press should cease, and if the pressure be maintained unrelaxed it will be found that in a short time further pressure may be applied and more liquid separated. In this way, by alternately exerting pressure and resting, the utmost limit of the power of the press may be gradually reached without undue strain. Screw presses have more ability to retain pressure than hydraulic presses: the valves of the latter frequently leak slightly, and the pressure has to be continually renewed.

QUESTIONS ON CHAPTER XIX.

EXPRESSION.

What is expression?

How many mechanical principles are recognized in the operation of expression, and what are they?

What is the principle of the spiral twist press?

What press is most useful in pharmaceutical operations, where very great power is not desired?

How many forms of screw presses are there?

Describe a single screw press.

What is the best material for press cloths?

What is the principal objection to the screw press?

Describe the Enterprise Co.'s horizontal screw press?

Describe the double screw press as proposed by Mr. Charles T. George.

What is the principle of the roller press?

Describe the wedge press.

What objection is there to it?

Describe the lever press.

What are its advantages?

What is an objection to it?

What is the principle of the hydrostatic or hydraulic press?

What are its special advantages?

In operating presses, what maxims should be observed?

Which can retain pressure most effectually, screw presses or hydraulic presses, and why?

CHAPTER XX.

PERCOLATION.

Percolation, or **Displacement,** is the process whereby a powder contained in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it. The importance of this process cannot be overestimated, as the progress made in pharmacy in America during the last half-century is largely due to the study and development of percolation, and the introduction of preparations which are the direct outgrowth of the process.

History.—The practice of exhausting wood-ashes of their soluble constituents by pouring water upon them after their introduction into a conical-shaped wooden vessel called a lye-hopper is an ancient one, and the process is still practised and known as *lixiviation*. The first attempt on record to apply the principle to powdered drugs was made by Count Real, who about the year 1815 invented a press which consisted of a metallic cylinder with a stop-cock in the bottom and containing a perforated diaphragm for supporting the substance, and with a tight cover at the top, to which was attached an upright tube, ten or twelve feet high, having a funnel soldered to its upper extremity: the cylinder was packed with the coarsely-ground drug, and water poured into the tube. The pressure of the column of water was so great, however, that the principal difficulty in using the apparatus was in securing tight joints, and in preventing the incomplete exhaustion of the drug on account of the too rapid passage of the water through it. M. Robiquet subsequently made some experiments to determine the power of ether as a solvent in extracting the fixed oil from the bitter almond: he observed that ether poured on powdered bitter almond displaced the fixed oil without mixing materially with it, and he published his observation. It was reserved, however, for the Boullay brothers, of Paris, in 1833, to apply the ideas of Real and Robiquet to drugs and medicinal substances in general, and to them belongs the credit of first demonstrating the value of the process of percolation in its pharmaceutical applications. The researches of the Boullays at once attracted the attention of American pharmacists, and the labors of Duhamel, Procter, Grahame, Squibb, and others during the last half-century, and the adoption of the process in the Pharmacopœias of 1840, 1850, 1860, 1870, and 1880, sufficiently show the character of the growth in favor of percolation. In Great Britain, France, and Germany the process is well known and is practised to some extent, but maceration still holds in these countries the chief place as a means of extracting the soluble principles of drugs.

Principle of Action.—*When a powder placed in a cylindrical vessel with a porous diaphragm below, is treated from above with a liquid capable of dissolving a portion of its substance, that portion of the fluid first in contact, in passing downward, exercises its solvent power on the successive layers of the powder until saturated, and is impelled downward by the combined force of its own gravity and that of the column of liquid above it, minus the capillary force with which the powder tends to retain it.* If the quantity of liquid added is not more than enough to satisfy the capillarity of the powder, no liquid will pass the diaphragm; but the careful addition of liquid upon the top displaces that absorbed in the powder without mixing materially with it, and takes its place, to be in turn displaced by a fresh portion of liquid. The instrument used to hold the powder is called a *percolator;* the liquid poured on top of the powder, the *menstruum;* the liquid coming from the percolator impregnated with the soluble principles, the *percolate.* In order thoroughly to understand the process of percolation as applied to powdered drugs, it must be remembered that the soluble principles of vegetable substances are in a hard and dry condition, and are generally contained in cells which are more or less disintegrated by the process of grinding: if the soluble principles could be perfectly separated from the insoluble cellular substance by any means, and be deposited in the interstices of the ground particles, percolation would indeed be a rapid process, for the descending column of liquid would immediately dissolve the soluble principles, which would be found in the receiving vessel, while the insoluble substances would remain in the percolator, and the separation would then be easily accomplished. But the powdering of the drug very partially separates the soluble principles from the insoluble, and the finest dust of the powder always contains a larger proportion of the soluble principles than of the insoluble substance, because the latter, often being largely ligneous, offers the greatest amount of resistance to disintegration: hence the first portion of the percolate is always the most dense, the most highly colored, and contains the largest proportion of the soluble principles, because the first portion of menstruum, in its descent through the powder, has the first opportunity to come in contact with the largest proportion of the soluble principles, which are to be found in the finer dust scattered through the powder, and in the thoroughly disintegrated particles, which offer but slight resistance to the passage of the menstruum. In every well-conducted experiment in percolation it will be noticed that, as the operation proceeds, each succeeding portion of percolate is less highly colored and less active than the one preceding it; and in the case of drugs containing easily-dissolved coloring-matter, an examination of the percolate will show that the shading is very marked, the lowest portion being very dense and dark-colored, the upper portion almost colorless, whilst in the intermediate liquid the gradations of the tint are clearly perceptible.

The directions of the United States Pharmacopœia upon percolation are as follows:

The process of percolation, or displacement, directed in this Pharmacopœia, consists in subjecting a substance or substances, in powder, contained in a vessel called a percolator, to the solvent action of succes-

sive portions of menstruum in such a manner that the liquid, as it traverses the powder in its descent to the recipient, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be destitute of color, odor, and taste, other than that possessed by the menstruum itself.

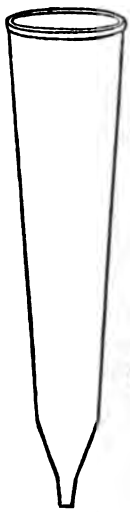
The percolator most suitable for the quantities contemplated by this Pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with its outer edge. The glass tube, which must not protrude above the inner surface of the cork, should extend from one and one-eighth to one and one-half inch (3 to 4 centimeters) beyond the outer surface of the cork, and should be provided with a closely fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum.

The shape of a percolator should be adapted to the nature of the drug to be operated upon. For drugs which are apt to swell, particularly when a feebly alcoholic or an aqueous menstruum is employed, a *conical* percolator is preferable. A *cylindrical* or only slightly tapering percolator may be used for drugs which are not liable to swell, and when the menstruum is strongly alcoholic, or when ether or some other volatile liquid is used for extraction. The size of the percolator selected should be in proportion to the quantity of drug extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds of its height. The percolator is best constructed of glass or stoneware, and is prepared for percolation by gently pressing a small tuft of cotton into the space of the neck above the cork, a small layer of clean and dry sand being then poured upon the surface of the cotton to hold it in place.

The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, whilst No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper, and the whole quantity poured from it into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed;

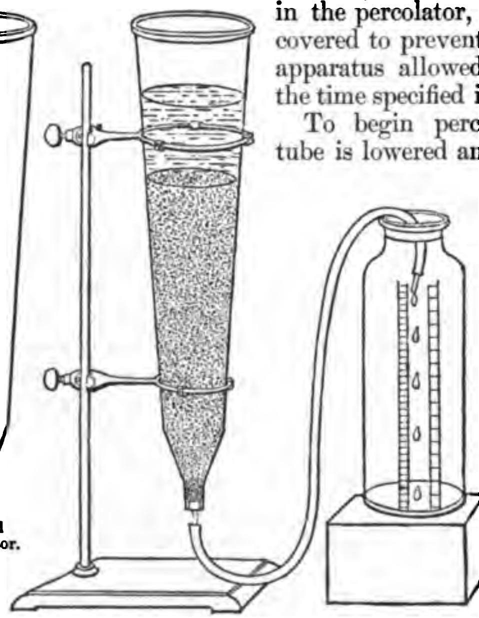
after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately fitting disk of filtering-paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, the height corresponding to its level in the percolator, which is now closely covered to prevent evaporation, and the apparatus allowed to stand at rest for the time specified in the formula.

FIG. 313.



Official percolator.

FIG. 313a.



Official percolation.

To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this recipient, the rapidity of percolation may be increased or lessened as may be desirable, observing, however, that the rate of percolation, unless the quantity of material taken in operation is largely in excess of the pharmacopœial quantities, shall not exceed the limit of ten to thirty drops in a minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

Fig. 313*a* illustrates an official percolation (U. S. 1880), the shape of the percolator and the arrangement of the exit-tubes being strictly according to the directions.

Shape of the Percolator.—In the U.S. Pharm. 1880 the shape and size of the cylindrical percolator preferred for pharmacopœial operations were definitely fixed (see Fig. 313). There can be no question that the glass cylindrical percolators (see Fig. 314) commonly furnished by the manufacturers are proportionally too broad for use in percolating drugs for fluid extracts where the quantity of drug is large in proportion to the quantity of menstruum; but for ordinary tinctures, where the conditions are reversed, they answer admirably. The inference then is obvious, the pharmacist should have percolators not only of different sizes, but also of different shapes. Fig. 315 shows the narrow percolator recommended by Prof. Oldberg. It is narrower than the cylindrical percolator directed by the U.S. Pharm. 1880. The studies on percolation during the last half-century have been directed towards simplifying the process, and the elaborate apparatus of Count Real and others has been replaced by the ordinary percolator and funnel. The conical percolator of the Pharmacopœia is understood to be a glass funnel (see Fig. 316).

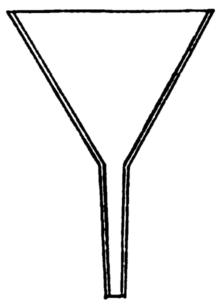
FIG. 314.

Plain percolator.

FIG. 315.

Oldberg's percolator.

FIG. 316.



Conical percolator.

Judgment is required in selecting a percolator for an operation. In making a fluid extract a comparatively narrow percolator should be chosen, because it is desirable that the menstruum should traverse a higher column of powder, for every drop of the menstruum must be economically applied. The rate of flow of the percolator is thereby proportionally diminished, the percolate becomes saturated more rapidly, and thus the operation is more easily controlled, provided the limit has not been exceeded. *The character of the drug influences the limit.* For instance, one which contains a large quantity of soluble matter, like kino, could not be successfully percolated in a narrow percolator, because the percolate would soon become so dense that it would cease to descend. In making tinctures and weaker preparations, a wider percolator is to be preferred, because the quantity of menstruum is greatly in excess of the quantity necessary to exhaust the drug, and more rapid action is desirable. Figs. 317, 318, and 319 show three percolators of the same height, but of very different shapes. Exactly the same weight of powder is represented in each. The great difference in the height of the columns of powder will be readily noticed, and illustrates the necessity for judgment in selecting percolators. If a fluid extract from the drug is to be made, the tall percolator, Fig. 317, should be chosen; if a strong tincture, Fig. 318 indicates the shape; whilst for a weak tincture, the funnel shown in Fig. 319 would be preferred; it being

understood that in each case the drug chosen is not an exceptionally difficult one to percolate.

The Degree of Comminution proper for each Substance must depend upon the physical structure of the drug, the ease with which the menstruum dissolves the active or desirable constituents, the length

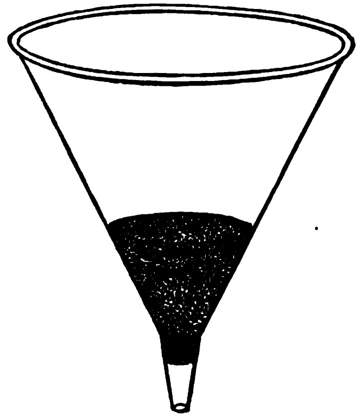
FIG. 817.

Narrow percolator, 16 oz. powder.

FIG. 818.

Ordinary percolator, 16 oz. powder.

FIG. 819.



Conical percolator, 16 oz. powder.

of time required to exhaust the powder, and the relative proportion of menstruum to drug. Nux vomica and ignatia are drugs having a tough, horny structure, in which the soluble constituents are embedded. If these drugs are to be quickly exhausted of their soluble principles, they must be in fine powder. On the other hand, gentian and rhubarb are drugs which part easily with their active constituents, because their structure is loose and quickly penetrated by the menstruum: therefore these may be readily exhausted when in coarse powder. The relative proportion of menstruum to drug also has a bearing in determining the fineness of the powder, for it is clear that if a fluid extract is to be made in which one hundred volumes shall represent *one hundred* parts by weight of the drug, the powder should be a finer one than would be required for a tincture where one hundred volumes are used to exhaust *ten* parts by weight of the drug. In all cases, whether coarse or fine powder is directed, the powder should be *uniformly divided;* and where the degree of fineness is specified, but a small proportion of the powder should be capable of passing through a sieve of the next higher grade of fineness, and this small proportion should be thoroughly distributed through the powder. The object of this is to permit the uniform descent of the liquid, for fine particles offer more resistance to the passage of the menstruum than coarse ones; and if the powder is not uniform, and the finer particles are deposited upon one side of the percolator, imperfect exhaustion may occur, through the passage of the greater portion of the menstruum upon the side of least resistance,—*i.e.*, through the coarser particles. After the powdered drug is moistened, it should be passed through a riddle or coarse sieve several times,

to render it uniform. The little sifter shown in Fig. 218 has been found very efficient for this purpose.

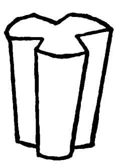
Moistening of the Powder.—The general rule in percolation is to moisten the powder, and there are very few instances in the official processes where it is not directed. The object of moistening the powder is very apparent. If a perfectly dry sponge is held in the hand and a gentle stream of water poured upon it, it will be noticed that very little water is absorbed by it; but if the sponge is thoroughly soaked, and all the water squeezed out that possibly can be, it will be found that it will greedily absorb water. Most drugs are vegetable substances which in their natural state were moist. The process of desiccation has hardened and dried the tissues, so that, like the sponge, they do not absorb moisture quickly, and when compressed, as they are when packed in a percolator, the resistance is still greater. If a dry powder, like ground orange-peel, is tightly packed in a glass percolator and water poured upon it, it will be noticed that the water will penetrate the powder but a short distance. Its further passage is prevented by the particles which are immediately in contact with the water, which have become swollen to such a degree that they press tightly against the sides of the percolator, and thus entirely overcome the gravitating force and penetrating power of the water. If, on the other hand, the powdered orange-peel is moistened *with sufficient water to satisfy its tendency to swell, before it is packed* in the percolator, the addition of water is followed by its slow percolation through the mass without stoppage, and the utility of moistening the powder is thus proved.

The special cases in which the powder should not be moistened are those in which the addition of menstruum would produce adhesiveness and cause the powder to form lumps that could not be easily penetrated, those in which the moistened powder would offer too little resistance to the passage of the menstruum, and those in which the menstruum is too volatile or too inflammable to render moistening desirable or safe. An instance of the first case is found in the so-called cold percolation of sugar in making syrups; instances of the second and third cases, in the preparation of the oleoresins where ether is used as the menstruum.

Packing the Powder.—The official directions with regard to this important part of the process of percolation vary continually. Where the degree of pressure is immaterial, no special directions are given. Where there is a likelihood of too much pressure being exerted, so that percolation would cease before it should, the directions are, "pack it moderately;" on the other hand, if there is danger of the operator allowing the menstruum to pass through too rapidly, so that the drug would not be exhausted of its activity, the directions are, "pack it firmly." The proper degree of pressure can be judged only from the character of the drug and the nature of the menstruum. If a porous, spongy drug is to be percolated with a menstruum largely aqueous, it must be moderately packed; but if the menstruum is alcoholic, it must be firmly packed. Before beginning to pack the powder, the throat of the funnel or of the percolator must be obstructed by a loose plug of absorbent cotton or a deeply-notched cork (see Fig. 320), or by some

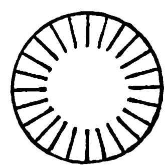
other method. The manner of inserting this obstruction is not very material. The cotton, however, should be dry and loosely inserted, and the cork either dry or moistened with the menstruum, care being taken not to moisten the cotton or cork with water unless the menstruum is aqueous, because if the drug to be percolated is resinous, the first portions of percolate which come through will be precipitated by the water in the cotton or on the cork. Instances have occurred where the percolation has been stopped from this cause. The direction of the Pharmacopœia to pour a small layer of sand upon the top of the cotton, to keep it in place, is, in our opinion, unnecessary. Where the notched cork is used, it is well to place over the top of the cork, when it is in place, a small circle of scored filtering-paper (see Fig. 321). This is slightly larger in diameter than the cork, and the edges are therefore reflected up the sides. A small quantity of the moistened powder will keep the cotton or the filtering-paper and cork in place just as well as the sand.

FIG. 320.



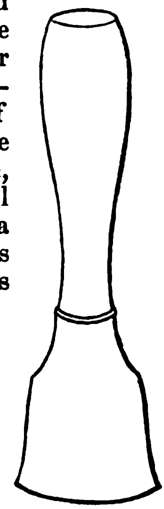
Notched cork.

FIG. 321.



Scored paper.

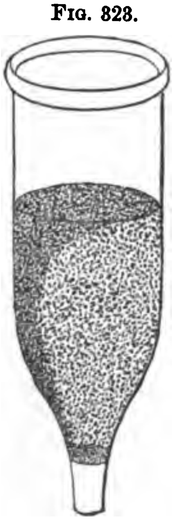
FIG. 322.



Packer.

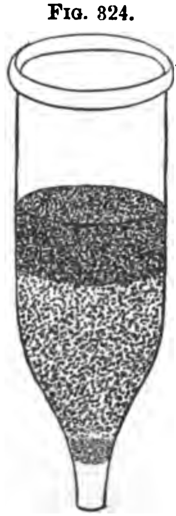
The moistened powder should be carefully deposited in the percolator in layers, each succeeding layer being packed according to the directions, "moderately" or "firmly," as the case may be, care being taken to use the same degree of pressure with each layer.

FIG. 323.



Imperfect packing.

FIG. 324.



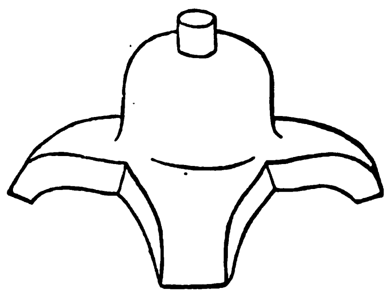
Proper packing.

Fig. 322 shows a convenient utensil for packing a percolator. It should be made of hard wood, preferably lignum-vitæ. The skill used in this part of the process will be proved by the manner in which the menstruum permeates the moistened powder. If the descent is regular and uniform, it is shown in a glass percolator by the line marking the descent of the menstruum being perfectly horizontal. If the line is irregular, it is easy to point out just where the pressure was insufficient or too great. Fig. 323 shows loose and irregular packing, too much pressure being made on the right side, the menstruum descending upon the left side unequally and escaping unsaturated. Fig. 324 illustrates a percolator which has been properly packed, the liquid descending uniformly.

Adding the Menstruum.—When the last portion of moistened powder is introduced into the percolator, a sheet of filtering-paper,

scored at the edges and slightly larger in diameter than the surface of the powder, should be laid upon it, for the purpose of causing the even distribution of the menstruum. A weight of some kind is usually placed upon the paper, to keep it from floating out of place. Clean pebbles, a bottle-stopper, or a glass funnel may be used, but in Fig. 325 is shown a glass tripod percolating weight, which has been made for this purpose by Whitall, Tatum & Co. It is easily cleaned, is not readily broken, and does not take up much room. Where the percolator is large enough to hold the whole of the menstruum, it may be at once added carefully. When this is not the case, and the menstruum must be added in divided portions, care must be observed to follow with the succeeding portion before the first has entirely disappeared, or otherwise fissures may appear in the powder, and the menstruum will of course then seek the outlet offering the least obstruction, and will leak through the fissures instead of percolating through the powder. This is more apt to occur in percolating very fine powders than in percolating coarse ones, although liable to take place in either. Where a large quantity of menstruum is required, a contrivance for continually supplying the menstruum should be used, in the form of an inverted bottle or flask (see Fig. 329), or any of the methods for continuous filtration (see Figs. 228 and 229) may be employed.

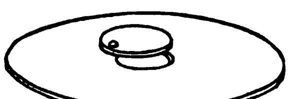
Fig. 325.



Percolating weight.

Previous Maceration is recommended when the structure of the powder is tough, when the soluble principles are not easily extracted by the menstruum, or when a comparatively large quantity of powder is to be exhausted by a small quantity of menstruum. It is obvious that maceration is going on constantly whilst the menstruum is traversing the powder during its gradual descent, and when the amount of menstruum is more than sufficient to exhaust the drug, previous maceration is merely a waste of time. Nevertheless, the framers of the Pharmacopœia, in order to prevent the possibility of an unskilful or ignorant operator's failing to exhaust a drug with the quantity of menstruum directed, have adopted in most cases the precaution of ordering previous maceration for a short time. This is best performed by moistening the drug, introducing it loosely into the percolator, and covering it closely to prevent loss by evaporation. This course has the additional advantage of allowing the drug to swell at the same time. A cover made of sheet-rubber (see Fig. 326), with a circular opening, is very useful in this connection. No attempt should ever be made to produce fluid extracts on the small scale without previous maceration.

Fig. 326.



Sheet-rubber cover.

Finishing the Process.—The official directions are frequently

definite in fixing the quantity of percolate to be received from a given quantity of powder, but the oft-repeated direction to "add the menstruum until the substance is exhausted" at once raises the question, When is a drug exhausted of its activity? This question can be properly answered only by knowing beforehand what the active principles of the drug are. A few examples will sufficiently illustrate this. The activity of nux vomica, opium, and cinchona resides in the bitter alkaloids: hence the *absence of bitterness* in the percolate in such cases indicates exhaustion. Cochineal and saffron are valued in pharmacy for nothing but the coloring-matter contained in them: hence the *absence of color* in the percolate indicates exhaustion. Catechu, galls, kino, krameria, etc., contain tannin, and this is the only valuable principle: the *absence of astringency* in the percolate in these cases, therefore, indicates exhaustion. The exhaustion of resinous drugs may be known by the absence of precipitation when the percolate is dropped into water. Where two or more active principles exist in a drug, the latter is not exhausted until the percolate is free from all of them. *The intelligent practice of the process of percolation, therefore, requires an accurate knowledge of the constituents and physical properties of medicinal substances.*

Choice of Menstrua.—Much labor has been bestowed by investigators in ascertaining the exact proportions of the usual solvents—water, alcohol, glycerin, etc.—that are best adapted for depriving drugs of such of their soluble principles as are desirable, and at the same time leaving untouched in the residue those principles which are either inert or objectionable. The special menstruum which is exactly adapted to the peculiar characteristics of the drug, and which will cause the retention of the soluble principles in a permanent form under the varying conditions of climate, and at the same time permit exposure to light, heat, and air without injury, can be determined only by experiment and experience. When new galenical preparations are proposed, the menstruum selected must therefore be merely tentative, and general principles must guide, until positive knowledge is secured. Alcohol would be indicated for active resinous drugs, diluted alcohol for simple bitter tonics, cathartics, etc., and diluted alcohol with glycerin for astringent drugs, etc. The selection of proper menstrua will be noticed, as occasion demands, in the chapters upon infusions, tinctures, extracts, fluid extracts, etc.

Absorbed Menstruum.—The amount of menstruum which a powder will absorb and retain after percolation ceases can never be accurately predetermined. If it is important to know beforehand the percentage of menstruum capable of being absorbed, a practical trial should be made upon the small scale, using the same powder and menstruum.

Substances possess very different capacities for retaining menstruum: those having a light, spongy structure hold more than hard ligneous drugs, and even the same drug will often vary in its capacity in this respect, whilst the amount of moisture present in the drug before it is percolated is never a constant quantity, varying sometimes as much as eight to twenty per cent. The advantages of percolation over maceration are very apparent in respect to the character of the liquid left in the residue: in maceration the liquid left in the residue is finished tincture; in per-

colation it is merely menstruum, the active portions of the drug having been dissolved in the preceding percolate. In large operations, from an economical point of view, it is desirable to recover absorbed menstrua when the residues contain sufficient alcohol to make it worth the necessary time and labor. Distillation is then resorted to, or the residue is treated with weak alcohol and subsequently with water. Where water causes swelling of the substance and a stoppage of the percolation, the residue may be mixed with clean sawdust, rice chaff, or other inert dry substance, and then percolated with water. Recovered distilled alcohol may be purified by treating it with potassium permanganate; twelve grains dissolved in a gallon of the percolate, and allowed to stand a few days, are usually sufficient: the purified alcohol may be decanted or filtered. Care must always be taken not to use unpurified recovered alcohol which is odorous on account of containing volatile oil obtained from a drug, or which may be otherwise impure.

Controlling the Flow of the Percolate.—The necessity for some method of controlling the flow of the percolate is apparent. In simple percolation this is effected by the degree of pressure used in packing the moistened drug, as has been previously explained. Judgment and experience are absolutely necessary to guide the operator. Various mechanical expedients have been used to accomplish the same purpose. In official percolation (see Fig. 313) the flow of the percolate is regulated by increasing or decreasing the difference in height between the end of the rubber delivery-tube and the height of the liquid in the percolator. In metallic percolators stop-cocks have been employed, but, owing to the difficulty of thoroughly cleaning them, their use has been almost entirely abandoned. In the following descriptions of special percolators it will be observed that the control of the flow of the percolate is one of the principal objects sought.

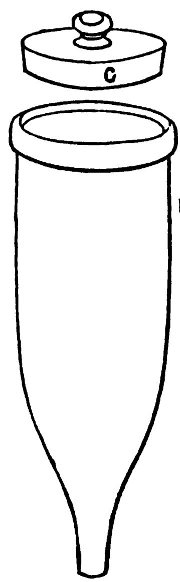
SPECIAL PERCOLATORS.

Stoppered Percolator.—Many modifications in the ordinary cylindrical or conical percolator have been suggested from time to time to suit special requirements. In Fig. 327 is shown a glass percolator proposed by Dursse, the special merit of which lies in the manner in which evaporation is prevented. This is effected by means of the ground-glass cover: the upper part of the percolator, R, is strengthened by a deep band; the glass cover, C, is carefully ground so as accurately to fit the percolator and make a nearly tight joint, which can be improved by moistening the edge with glycerin. If the percolate should flow too freely, it can generally be checked by screwing in the cover of the percolator; should it flow too slowly, a small piece of twine inserted between the cover and the side will permit the necessary pressure of the atmosphere. The graceful outlines of this percolator, and the evident care used in its manufacture, may be mentioned as points in its favor.

Well-tube Percolator.—An excellent method of percolation which has been used by Dr. E. R. Squibb for a number of years, and is still employed, is shown in Fig. 328. It is based upon the principle of drawing water from a well automatically as fast as it accumulates. This

is effected by the use of a well-tube placed in the centre of an ordinary jar or pot and held in its place by the powdered drug which is packed around it. The menstruum is poured upon the drug, and, after percolating through, collects in the well-tube, from which it is drawn off by an ingeniously-constructed syphon. The practical value of this method warrants a detailed description. It may be used for either large or small operations.

FIG. 327.



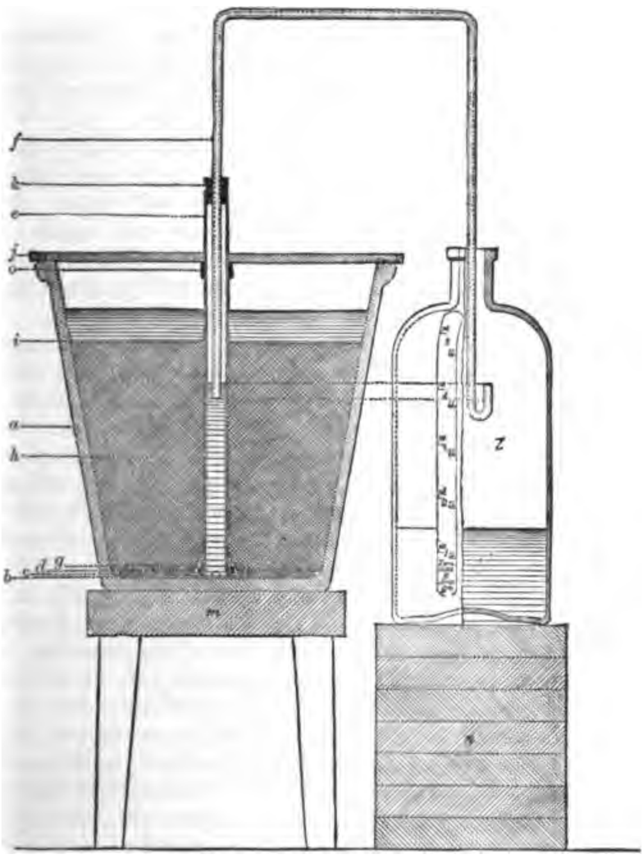
Dursee's percolator.

The percolator is a stone-ware pot of about two gallons' capacity, capable of holding six pounds of most drugs, and mounted on a suitable stand. A disk of blanket, *b*, is cut of such a size and shape as to lie flat upon the bottom and cover it entirely. Another disk, *c*, of the same material, but a little larger, is made with a crucial incision (X) in the centre, so that it may be stretched over the end of the well-tube, *e*. This is a piece of glass tube about twelve inches long, having an internal diameter of half an inch, and irregularly notched or gnawed off obliquely at the lower end. One end of this well-tube is pushed through the crucial cut in the centre of the upper disk of blanket, and this blanket is pushed to the other end of the tube, so that the corners made by the crucial cut are reflected up against the outside of the tube. These corners are then tied firmly to the tube by passing twine around them, or are secured by a stout rubber band, *g*, made of a section of rubber tubing of proper size. A disk of filtering-paper, *d*, larger than the upper blanket, *c*, with a crucial cut in the centre, and scored round the edge so as to lie flat against the sides of the percolator where reflected up against them, is pushed down upon the upper blanket, the well-tube passing through the cut in the centre. If now a cork be temporarily stuck into the well-tube to keep out the moistened powder, the percolator is ready to receive its charge, which is packed around the well-tube and upon the disks of paper and blanket so as to occupy the main body of the percolator, *h*, up to about the position of *i*. When the charge, having been properly moistened, rubbed, and sifted, so as to be entirely uniform and free from wet lumps, is packed around the well-tube loosely or firmly according to the nature of the substance and the menstruum, its surface is covered by a disk of muslin or paper, *i*, cut so as to lie flat and smoothly upon the surface. The object of this is to distribute the menstruum as it is poured on, and to prevent the stream from breaking up and deranging the surface. Should this paper disk show a tendency to float in the stratum of menstruum, it may be held down by a few fragments of glass. The percolator is then ready to receive the menstruum or weak percolate, and a stratum of the liquid should be carefully kept covering the entire surface until the whole mass of the substance to be percolated is saturated. The cork is to be taken from the well-tube before the liquid is poured on, and then the liquid will flow down into the substance like a piston, pushing the interstitial

air before it, the air passing out through the blankets and the well-tube; finally the liquid will rise in the well-tube until its surface is within an inch or so of the surface of the liquid outside.

The whole substance is now in a perfect condition for maceration, and the surface should be left covered with the liquid to the depth of at least half an inch. A short section of rather thick rubber tubing, *o*, should be stretched over the upper end of the well-tube, and slipped down so as to support the centre of the cover. A tightly-fitting cover, *j*, made

FIG. 328.



Well-tube percolator (Squibb).

of sheet-rubber a quarter of an inch thick, with a hole in the centre for the well-tube, is then put on. The syphon, *f*, is made of glass tubing of about an eighth of an inch bore, bent twice at right angles, the two legs being each about twelve inches long. The outer leg is a little longer than the inner one, and turned up upon itself for about three-quarters of an inch, as shown in Fig. 328. The legs should have only such a difference in length that the inner one will reach the bottom

of the well-tube when required, and when measured upon the outer one will reach to about midway of its turned-up end.

This construction prevents the syphon from emptying itself at any time, for when the liquid is drawn over by the syphon until the surface of liquid in the well-tube falls to a level with the end of the turned-up portion, as shown by the lines in Fig. 328, the columns of liquid in the syphon will be of equal length and will counterbalance each other, and the flow will cease without emptying the syphon. But as soon as the level of the liquid in the well is raised by fresh additions of menstruum on the substance, the flow will recommence at a rate proportionate to the difference of levels, and may be readjusted to the required rate by slipping the syphon up or down in the cork, *k*, in the upper end of the well-tube. This cork should be bored to fit the syphon so tightly as to hold it in any position, and should have a groove filed longitudinally on its outer side, to allow free exit of air.

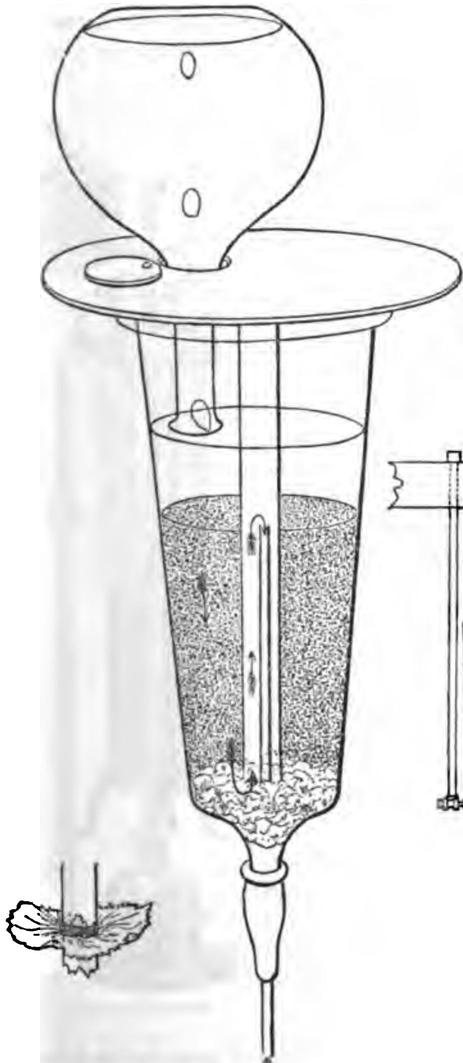
If it is desirable at any stage in the percolation to stop the process, the syphon may be gently lifted until the leg in the well-tube is above the level of the percolate there, when the flow will cease. It may be started by simply pushing the leg down into the tube again: this is a practical convenience which is greatly appreciated. If the syphon should accidentally empty itself, the flow is easily started by attaching a short rubber tube to the curved end and applying suction.

Double-tube Percolator.—This differs from the well-tube percolator just described in the use of an ordinary percolator, the absence of the syphon, and the substitution of a simple, straight tube which is free to move up or down inside of the well-tube at the discretion of the operator. Fig. 329 illustrates its mode of action. A central well-tube having the lower end irregularly broken is placed in an ordinary glass percolator, upon a tuft of absorbent cotton, or, as in Dr. Squibb's percolator, a circular piece of muslin is securely tied upon the tube a short distance from the bottom, as shown in the small cut in Fig. 329, and the end of the tube rests upon a perforated cork fitting tightly in the neck of the percolator, as proposed by W. S. Thomson in his description of a similar apparatus. The control of the flow of the percolate is effected by raising or lowering the small tube which passes into the well-tube, and which is held in place by passing through the perforated cork in the neck of the percolator already mentioned, or through a perforated rubber nipple slipped over the end, as suggested by Windolph, or through a piece of rubber tubing. If previous maceration is directed, the narrow tube may be pushed up until the upper orifice is above the level of the menstruum, and of course above the level of the percolate in the well-tube. When it is desirable to begin percolating, the tube is gently rotated with a downward movement until the level of the percolate is reached, and then percolation proceeds regularly, the course of the menstruum being indicated by the arrows in Fig. 329. The rapidity of the flow is increased by lowering the tube, and decreased by raising it.

Suspended Percolator.—In large operations it is necessary to employ means to facilitate not only the percolation, but also the packing and emptying and other subordinate but essential parts of the process. Fig. 330 shows a percolator in use by Hance Brothers & White. The

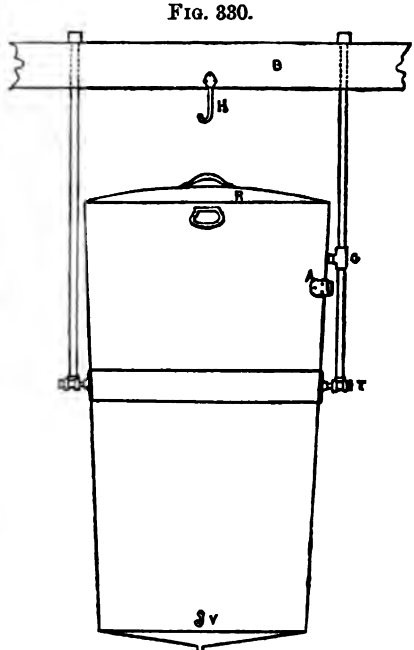
large percolator of tinned copper is suspended by trunnions, T, which are fastened to a stout band encircling the percolator slightly above the centre; two steam-pipe supports are secured to a strong beam, B, above, and the trunnions rest in tees, which are screwed to the end of the pipe-supports: the sliding tee, G, is dropped into the cup-shaped catch, A, when it is desired to retain the percolator in an upright position. The special advantage in this arrangement is observed, however, when an operation is concluded: a residue-car may then be wheeled opposite to the percolator, and the tee pushed up so as to permit the percolator to swing on the trunnions: the percolator may then be turned upside down

Fig. 329.



Double-tube percolator.

Fig. 330.



Suspended percolator (Hance's).

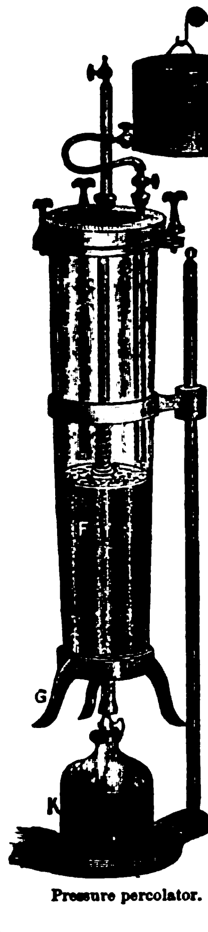
with the greatest ease, its conical shape facilitating the discharge of the residue.

Pressure Percolators.—Within a few years percolation by pressure

has come into vogue in various parts of the country, and there are at the present time several forms of pressure percolators upon the market; each one differing somewhat from the others in detail, but all based upon the same principle,—that of forcing the menstruum through the powder at a greater rate of speed than it would pass if it depended alone on the force of gravity.

The pressure is usually exerted through a column of menstruum entering the percolator at the top, the menstruum being supplied and the column sustained from a reservoir of the liquid suspended above it at a height of from three to ten feet. It will be noticed that Count Real's apparatus, invented in 1815, was based upon this principle (see page 263), and since then Stearns, Rosenwasser, Berry, Suits, Anderson, and others have advocated or introduced apparatus under various names by which percolation is carried on under pressure. It must suffice in this place to describe briefly one of the newer pressure percolators, that of Suits, full and detailed information being readily obtained from the manufacturers of any of them. Fig. 331 shows one of the best forms, the glass percolator B, protected by three iron bands, having at the top a tight cover made of plated sheet copper, having two stop-cocks; the cover is made air-tight by being clamped between two flat sheet-rubber rings; the bottom of the percolator has a stop-cock cemented in it; the moistened powder, F, is kept in place and some pressure exerted by means of the porous metal diaphragm, the spring E, and the metal tube C which passes through an air-tight joint in the top. The tripod, G, is not used during the percolation, but is useful in supporting the percolator whilst packing. It is possible with this apparatus to macerate the powder under pressure, and at the end, after all of the menstruum has been run into the percolator and hydrostatic pressure is no longer available, a convenient rubber bulb air-pump may be used to force air into the percolator to maintain the pressure. This apparatus may be used to great advantage in filtering oils under pressure, or as a bottle-filler. After an extended practical trial of percolation by pressure, the author has reached the conclusion, that, whilst there are some percolating operations in which it can be used with advantage, for the great majority the pressure is unnecessary, just as perfect results being reached by the use of as simple a percolator as a glass funnel or cylinder of the well-known form.

FIG. 331.

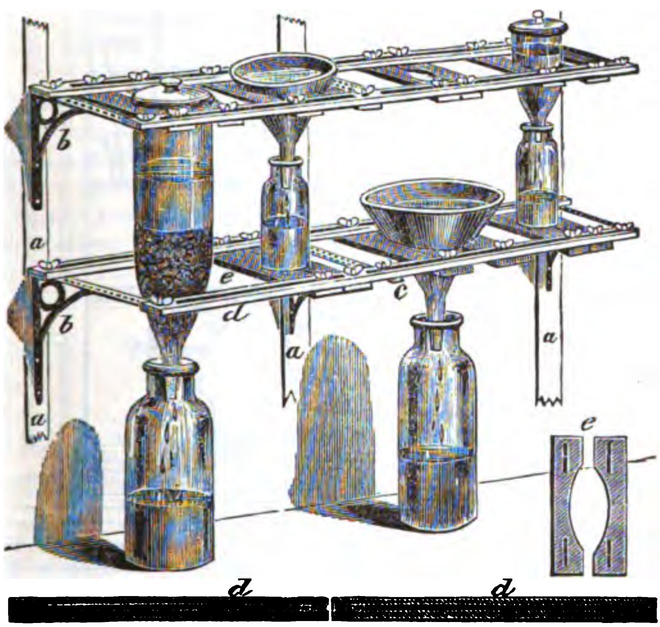


Pressure percolator.

Methods of Supporting Percolators.—The ordinary retort-stands

are often used to support percolators, but these are generally flimsy and unsatisfactory. The one shown in Fig. 164, particularly if used with split rubber-tube sections, as seen in Fig. 167, is much to be preferred. The stand shown in Fig. 332 was devised by the author in 1875, and has been in constant use since. It is conveniently fastened to the wall

FIG. 332.



Percolation stand.

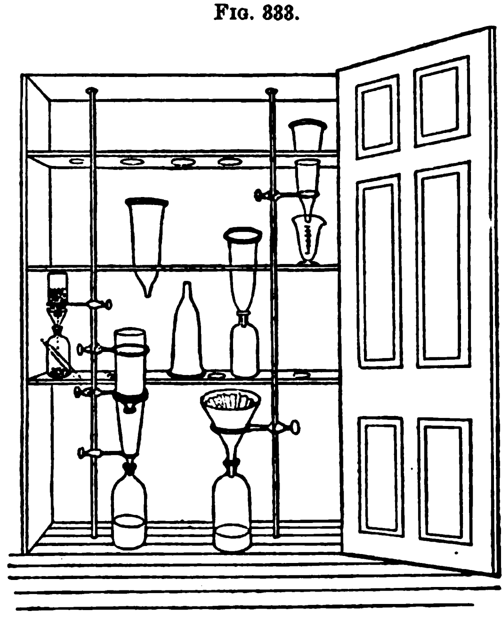
in front of the working counter. Two long strips having slots down the centre are supported on brackets, and short cross-strips having their inside edges hollowed out are fastened to the long strips by thumb-screws. This arrangement permits the adjustment of the cross-strips so that either a large or a small percolator or funnel can be supported, as shown in the cut, at any desired height. This stand is capable of enlargement by means of additional brackets and strips. If a wall counter is not available, a frame may be made extending over an ordinary counter, which will serve as well for a support, care being taken that the strips and frame are heavy enough to bear without strain any weight likely to be placed upon the stand. The special advantage of a percolating stand is, that it enables all percolating and filtering operations to be carried on with convenience in one place, thus saving time and labor.

Percolation Closet.—The retort-rings shown in Fig. 164 have been used by James T. Shinn in a convenient percolation closet, shown in Fig. 333. Two lengths of ordinary five-eighths-inch iron steam-pipe are fastened securely to the top and bottom of the closet, at a convenient distance from the shelves. The retort-rings may be adjusted to the desired height, and it is thus possible to carry on several percola-

tions or filtrations at the same time, away from the other operations of the shop, in a closet with a closed door.

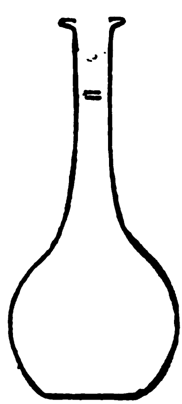
Receiving Bottles.—A series of bottles of various sizes should be reserved for use in receiving percolates. Where especial accuracy is necessary, a flask with a double mark on the neck should be used (see Fig. 334). Bottles with comparatively wide necks are to be preferred for receiving bottles. A paper strip may be pasted on the side, and accurately measured quantities of water poured in, carefully marking the height of each addition; upon the opposite side corresponding metric quantities may also be placed (see Fig. 335). J. M. Maris & Co. furnish narrow receiving bottles (metric and old form, and both systems on the same bottle) (Fig. 336). The graduations are accurately engraved on the glass, and arranged, at the author's suggestion, to suit the quantities of the U. S. P. 1890. These, unlike the home-made receivers, are permanently marked and of elegant appearance.

FIG. 333.



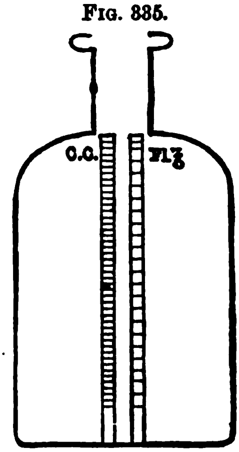
Percolation closet (Shinn).

FIG. 334.



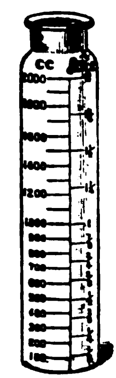
Receiving flask.

FIG. 335.



Receiving bottle.

FIG. 336.



Receiving bottle (all glass).

Repercolation, as its name indicates, is the process of percolating substances with percolates, or, as defined by Dr. E. R. Squibb, the

author of the process, "the successive application of the same percolating menstruum to fresh portions of the substance to be percolated." The principal object of repercolation is to effect the saving of alcohol and alcoholic menstrua by accomplishing the saturation of the menstrua, as nearly as possible, by passing the unsaturated or weaker percolate from one portion of the drug through another portion, and again passing the unsaturated or weaker percolate from this second portion through a third portion. The weak percolate from this last portion is generally set aside, to be used in succeeding operations upon the same drug in the place of fresh menstruum. This process is useful only in those operations where the relative proportion of menstruum used is small, as in the fluid extracts and similar concentrated preparations. Practical illustrations of the use of this process may be seen under Fluid Extracts.

Fractional Percolation is the term employed by Prof. C. Lewis Diehl and others to define percolation when applied to two successive portions of powder, the principle of action being identical with that of repercolation.

QUESTIONS ON CHAPTER XX.

PERCOLATION.

What is percolation or displacement?

What is lixiviation?

To whom belongs the credit of first demonstrating the value of the process of percolation in its pharmaceutical applications?

What is the principle of action in displacement?

What is the instrument used to hold the powder called?

What is the liquid poured on the top of the powder called?

What is the liquid which passes through the powder called?

According to directions given in the U. S. Pharmacopœia, in what does the process of percolation consist?

When the process is successfully conducted, how will the first portion of the percolate compare with the succeeding portions as regards color, odor, etc.?

What shape or shapes are most suitable for percolating such quantities as are directed by the U. S. P.?

Of what material may it best be constructed?

Give the directions for preparing and putting into the percolator a powder for percolation.

Give directions for pouring on the menstruum and starting the percolation.

How may the flow of the percolate be regulated so as to run with greater or less rapidity?

How may a layer of menstruum be kept constantly above the powder, and why is this desirable?

In what cases may narrow percolators be advantageously used, and in what cases wide ones?

Why is a narrow percolator preferable for making fluid extracts?

Upon what depends the proper degree of comminution for a substance to be subjected to percolation?

What happens when a powder of unequal degrees of fineness is subjected to percolation?

What is the object of moistening a powder before subjecting it to percolation?

In what special cases should the substance not be moistened?

What is the object of the directions in the U. S. P. given for packing powders in percolation, such as "pack it moderately," "pack it firmly," etc.?

In packing a percolator or funnel, how is the powder prevented from running through?

How should a powder be packed in a percolator so as to insure its being packed uniformly?

After adding a portion of menstruum to a powder in a percolator, should the surface be allowed to become dry, or should the supply of menstruum be continuous? Why?

Is maceration previous to percolation desirable? Why?

In the process of percolation the direction is often given, "add the menstruum until the substance is exhausted." How may it be known when a drug is exhausted? Give examples.

In the choice of menstruums, in what cases would alcohol be indicated? In what cases diluted alcohol?

Where would the addition of glycerin be advisable?

What advantage has percolation or maceration as regards the absorbed liquid left in the residue?

How can alcohol absorbed in residues be recovered?

How can the alcohol so recovered be purified?

Describe Dursse's percolator, Dr. Squibb's well-tube percolator, the double-tube percolator.

What is the object of having a percolator suspended on trunnions?

Describe percolation by pressure.

How are percolators ordinarily supported?

What is the objection to the ordinary retort-stands?

Describe a percolating stand that would be more satisfactory.

What is the advantage of a percolating closet.

How may receiving bottles be conveniently marked?

What is repercolation?

What is its principal object?

In what operations is repercolation useful?

What is fractional percolation?

PART II.

OFFICIAL PHARMACY.

THE various processes which are used in making the official preparations having been considered in Part I., as solution, filtration, digestion, percolation, maceration, expression, etc., it is most appropriate now to take up these preparations and classify them. Those which form natural groups will be brought together in such a manner as to facilitate the study of their general features. Each chapter will begin with a definition and description of the class of preparations treated of; then will follow a table giving a succinct view of the individual preparations forming the class; and after this, the official processes will be found arranged alphabetically. Detailed comments upon the preparations are reserved for the subsequent chapters, the object being at this time to familiarize the student with the *various forms* of official preparations and fix their general characteristics upon the mind. The following diagram will serve to give a complete view of the classification: it should be carefully examined at the outset, and referred to again after the classes have been studied in detail.

OFFICIAL PREPARATIONS.[1]

LIQUIDS.		SOLIDS.	
Made without percolation or maceration.	Made by percolation or maceration.	Made by percolation or maceration.	Made without percolation or maceration.[2]
Aqueous Solutions.	**Aqueous Liquids.**	Extracts.	Powders.
Waters.	Infusions.	Resins.	Triturations.
Solutions.	Decoctions.		Masses.
Aqueous Solutions containing Sweet or Viscid Substances.	**Alcoholic Liquids.**		Confections.
Syrups.	Tinctures.		Pills.
Honeys.	Wines.		Troches.
Mucilages.	Fluid Extracts.		*Cerates.*
Emulsions.	**Ethereal Liquids.**		*Ointments.*
Mixtures.	Oleoresins.		*Plasters.*
Glycerites.	**Acetous Liquids.**		*Papers.*
Alcoholic Solutions.	Vinegars.		Suppositories.
Spirits.			
Elixirs.			
Ethereal Solutions.			
Collodions.			
Oleaginous Solutions.			
Liniments.			
Oleates.			

[1] Those used internally are in Roman type; those used externally, in Italics.
[2] The preparations in this class are mostly extemporaneous, and will be considered under Part V.

CHAPTER XXI.

AQUEOUS SOLUTIONS.

Aquæ. *Waters.*

THE class of preparations termed *waters* are known also as medicated, aromatic, or distilled waters, and may be simply defined as *aqueous solutions of volatile substances.* The German Pharmacopœia and French Codex, however, recognize as waters solutions of non-volatile substances. The volatile substances used in the preparation of waters are either solid, liquid, or gaseous, and the following methods have been employed in effecting their solution: 1. Simple solution in cold water. 2. Solution in hot water. 3. Filtration through an absorbent powder. 4. Percolation through cotton saturated with the substance. 5. Distillation.

Most of the medicated waters are used as pleasant vehicles and solvents for the administration of various remedies, and are solutions of aromatic volatile oils. There are *eighteen* official waters, excluding ordinary water.

1. Simple Solution in Cold Water.—This method is resorted to when the proportion of the volatile substance is small enough to dissolve *easily* in the quantity of water required. The process where a volatile liquid is the medicating substance is, to agitate it with the water until dissolved, and then to filter the solution. In the case of the gaseous solutions, the gas is passed through the water until a solution of the desired strength is obtained. (See Solution of Gases, p. 205.) Of the eighteen official waters, three are distilled, four are solutions of gases, six are solutions of volatile oils, two are diluted distilled waters, one is a solution of a volatile solid, and two are solutions of volatile liquids.

Official Waters made by Simple Solution.

Name.	Proportion of Liquid dissolved.	Uses and Dose.
Aqua Amygdalæ Amaræ.	0.1 per cent. of Oil of Bitter Almond.	Pleasantly flavored vehicle, f℥ij.
Aqua Creosoti.	1 per cent. of Creosote.	Antiseptic and used locally, f℥i to f℥iv.
Aqua Chloroformi.	Saturated solution.	Sedative and vehicle.

Official Waters made by passing Gases through Water.

Name.	Proportion of Gas dissolved.	Uses.
Aqua Ammoniæ.	10 per cent. of gaseous Ammonia.	Stimulant, caustic.
Aqua Ammoniæ Fortior.	28 per cent. of gaseous Ammonia.	Rubefacient, escharotic.
Aqua Chlori.	0.4 per cent. of gaseous Chlorine.	Antiseptic, stimulant.
Aqua Hydrogenii Dioxidi.	3 per cent. of pure Dioxide.	Antiseptic.

2. **Solution in Hot Water.**—This method is founded upon the fact that most of the volatile oils are much more soluble in hot water than in water of ordinary temperature: hence, if the volatile oil is thoroughly agitated with hot water in a metallic vessel, such as a tin can or a bottle, and allowed to stand until the excess has separated, if care is used, the water will be found to be saturated: it may then be decanted and filtered.

3. **Filtration through an Absorbent Powder** is the process which has been most frequently employed: the object of using the powder is to divide thoroughly the oil, or volatile liquid, and expose a greater surface, so that the water in filtering through it may become completely saturated. The powder most frequently used is magnesium carbonate, but this is sometimes objectionable on account of being slightly soluble in water. Calcium phosphate, kaolin, powdered glass, silica, powdered pumice-stone, charcoal, paper pulp, precipitated chalk, sugar, etc., have been suggested as substitutes, but there are quite as forcible objections to be urged against these as against the magnesium carbonate. Where solutions of alkaloids or of silver nitrate are needed, distilled water alone should be used. The present official method directs the use of precipitated calcium phosphate, but purified magnesium carbonate is preferable.

4. **Percolation through Cotton impregnated with the Substance.**—This was the process directed to be used in the U. S. P. 1880; it was abandoned in the revision of 1890 on account of its inconvenience and wastefulness. The oil or volatile liquid is distributed upon the fibres of cotton, which are then pulled apart in order to secure thorough division; the saturated cotton is packed in a funnel, and the water poured upon it. In its passage downward the water dissolves the oil and passes out impregnated with the odorous substance. The presence of undissolved floating oily drops in the finished preparation has constituted one of the greatest objections to this process. It is an improvement to insert a plug of dry cotton in the throat of the funnel before placing the saturated cotton in position: this prevents the oily drops which may escape solution from being carried down by the water as it percolates through. Too much care cannot be exercised in selecting the volatile oils, which should be fresh and of the best quality.

Official Waters made by Filtration through an Absorbent Powder.

Name.	Proportion.	Use and Dose.
Aqua Anisi.	0.2 per cent. of Oil of Anise.	Pleasant vehicle, f℥i.
Aqua Camphoræ.	0.8 per cent. of Camphor dissolved in Alcohol.	Mild antispasmodic, f℥ss.
Aqua Cinnamomi.	0.2 per cent. of Oil of Cinnamon.	Pleasant vehicle, f℥i.
Aqua Fœniculi.	0.2 per cent. of Oil of Fennel.	Pleasant vehicle, f℥i.
Aqua Menthæ Piperitæ.	0.2 per cent. of Oil of Peppermint.	Pleasant vehicle, f℥i.
Aqua Menthæ Viridis.	0.2 per cent. of Oil of Spearmint.	Pleasant vehicle, f℥i.

5. **Distillation.**—This is the best process for preparing medicated waters, and should be used wherever practicable. If the fresh drug can be procured, it should always be used in preference to that which has been dried, because in the process of desiccation there is usually a loss of the agreeable volatile constituents. Metallic distillatory apparatus is preferably employed (see page 166). If the drug containing the oil-cells has a loose structure and is quickly penetrated by hot water, so that the oil-cells are easily ruptured, the drug may be introduced without previous contusion or grinding: it will usually be found, however, most economical to cut or grind the drug coarsely. Most distilled waters acquire an unpleasant empyreumatic odor as soon as they are distilled; this passes off gradually upon exposure to air, if care has been taken not to expose the drug to the action of direct heat during distillation. If no precautions are taken to protect the drug from partial burning, the odor of the carbonized substance will always be noticeable in the distilled water, rendering the product worthless. Fig. 182 shows a copper wire cage contrived by the author to obviate the difficulty just described: the surface of the cage is hemispherical; it rests, after being partially filled with the drug, upon the flat bottom of the still, and thus the contact of the substance with the heated surface is avoided: the meshes of the cage are coarse enough to permit the free passage of vapors and the boiling water through them. Although distillation by the use of steam may be most convenient upon the large scale, Vuaflart and Machet have shown that rose and orange-flower waters distilled over a naked fire keep better than those distilled by steam heat.

Preservation.—Distilled waters should not be made in larger quantities than can be used within a reasonable time, because they deteriorate when long kept, a flocculent precipitate forming in them, and ultimately they lose all traces of their usually agreeable odor. Microscopic plants belonging to the order Confervoideæ will often be found in medicated waters. These are usually tufts of articulated filaments, propagated by very minute spores from the atmosphere which have found lodgment in the water. Their presence renders the medicated water unsightly, and when in large proportion they must be regarded as injurious. If the aromatic water is heated and introduced into a bottle with a side opening near the bottom (like a douche-bottle) to which a rubber tube with a pinch-cock is attached, and a tuft of cotton pushed into the *neck* of the bottle, any spores originally present in the water will be killed by the heat, and the future growth of confervæ will be prevented by the interception of the spores by the cotton. It usually suffices, however, to heat the medicated water and introduce it at once into small bottles, which are to be completely filled, tightly sealed, and kept in a cool, dark place. Alcohol is sometimes added as a preservative, but this generally serves its purpose only a short time, as it cannot be added in sufficient quantity to preserve the water permanently, on account of its interference with the therapeutic action. The small percentage of alcohol in the medicated water is converted into acetic acid when long kept, and thus the preparation is soured. Glycerin and syrup have been suggested as preservatives. In the writer's experience they are not of much value unless used in large and inadmissible quantities.

Official Waters made by Distillation.

Name.	Proportion of Material used.	Use and Dose.
Aqua Aurantii Florum Fortior.	Water saturated with Oil of Fresh Orange Flowers.	Used for making Orange Flower Water.
Aqua Aurantii Florum.	Stronger Orange Flower Water, Distilled Water, each, 1 vol.	Mild sedative vehicle, f℥ss.
Aqua Destillata.	800 parts distilled from 1000 of water.	Solvent.
Aqua Rosæ Fortior.	Water saturated with Oil of Rose petals.	Used for making Rose Water.
Aqua Rosæ.	Stronger Rose Water, Distilled Water, each, 1 vol.	Pleasant vehicle, f℥i.

PRACTICAL PROCESSES FOR OFFICIAL WATERS.

AQUA AMYGDALÆ AMARÆ. *U. S.* Bitter Almond Water.

	Metric.	Old form.
Oil of Bitter Almond	1 C.c.	15 minims.
Distilled Water	999 C.c.	2 pints.
To make	1000 C.c.	2 pints.

Dissolve the Oil in the Distilled Water by agitation, and filter through a well-wetted filter.

AQUA ANISI. *U. S.* Anise Water.

	Metric.	Old form.
Oil of Anise	2 C.c.	30 minims.
Precipitated Calcium Phosphate	4 Gm.	60 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Oil of Anise with the precipitated Calcium Phosphate, add the Water gradually, under constant trituration, and filter.

AQUA AURANTII FLORUM. *U. S.* Orange Flower Water.

	Old form.
Stronger Orange Flower Water,	
Distilled Water, of each, one volume	8 fl. oz.
	1 pint.

Mix them immediately before use.

AQUA AURANTII FLORUM FORTIOR. *U. S.* Stronger Orange Flower Water.

[AQUA AURANTII FLORUM, PHARM. 1880. TRIPLE ORANGE FLOWER WATER.]

Water saturated with the volatile oil of fresh Orange Flowers, obtained as a by-product in the distillation of the Oil of Orange Flowers. It should be kept in loosely-stoppered bottles, in a dark place.

Stronger Orange Flower Water should be neutral to litmus paper, and possess a strong odor of fresh orange flowers.

It should be colorless and clear, or only faintly opalescent, not mucilaginous, and give no reaction with hydrogen sulphide T.S. or ammonium sulphide T.S. (absence of *metallic impurities*).

AQUA CAMPHORÆ. *U. S.* Camphor Water.

	Metric.	Old form.
Camphor	8 Gm.	117 grains.
Alcohol	5 C.c.	76 minims.
Precipitated Calcium Phosphate	5 Gm.	73 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Camphor with the Alcohol and Precipitated Calcium Phosphate, then with the Water gradually added, and filter.

AQUA CHLORI. *U. S.* Chlorine Water.

An aqueous solution of Chlorine [Cl = 35.37], containing at least 0.4 per cent. of the gas.

	Metric.	Old form.
Manganese Dioxide	10 Gm.	146 grains.
Hydrochloric Acid	35 C.c.	9 fl. dr.
Water	75 C.c.	2 fl. oz. 3½ fl. dr.
Distilled Water	400 C.c.	12 fl. oz. 6½ fl. dr.

Place the Dioxide in a flask connected by a suitable tube with a small wash-bottle containing 50 C.c. [old form 1 fl. oz. 5 fl. dr.] of Water, and connect this with a bottle having a capacity of 1000 C.c. [old form 2 pints], and containing 400 C.c. [old form 12 fl. oz. 6½ fl. dr.] of Distilled Water which has previously been boiled and allowed to cool. Add to the Dioxide in the generating flask the Hydrochloric Acid, previously diluted with 25 C.c. [old form 6½ fl. dr.] of Water, and, by means of a sand-bath, apply a gentle heat. Conduct the generated Chlorine through the Water contained in the wash-bottle into the bottle containing the Distilled Water, which should be loosely stopped with cotton and kept, during the operation, at a temperature of about 10° C. (50° F.). When the air has been entirely displaced by the gas, disconnect the bottle from the apparatus, and, having inserted the stopper, shake the bottle, loosening the stopper from time to time, until the gas ceases to be absorbed. If necessary, reconnect the bottle with the apparatus, and continue passing the gas and agitating until the Distilled Water is saturated. Finally, pour the Chlorine Water into small, dark amber-colored, glass-stoppered bottles, which should be completely filled therewith, and keep them in a dark and cool place.

Chlorine Water, even when kept from light and air, is apt to deteriorate. When it is required of full strength, it should be freshly prepared.

A clear, greenish-yellow liquid, having the suffocating odor and disagreeable taste of Chlorine, and leaving no residue on evaporation.

It instantly decolorizes dilute solutions of litmus, indigo, and other vegetable coloring matters.

When shaken with an excess of mercury until the odor of Chlorine has disappeared, the remaining liquid should be at most but faintly acid (limit of *hydrochloric acid*).

On adding 17.7 Gm. of Chlorine Water to a solution of 1 Gm. of potassium iodide in 10 C.c. of water, the resulting deep-red liquid should require for complete decoloration not less than 20 C.c. of decinormal sodium hyposulphite V.S. (corresponding to at least 0.4 per cent. of Chlorine).

AQUA CHLOROFORMI. *U. S.* Chloroform Water.

Chloroform,
Distilled Water, each, a sufficient quantity.

Add enough Chloroform to a convenient quantity of Distilled Water, contained in a dark amber-colored bottle, to maintain a slight excess of the former, after the contents have been repeatedly and thoroughly agitated.

When Chloroform Water is required for use, pour off the needed quantity of the solution, refill the bottle with Distilled Water and saturate it by thorough agitation, taking care that there be always an excess of Chloroform present.

AQUA CINNAMOMI. *U. S.* Cinnamon Water.

	Metric.	Old form.
Oil of Cinnamon	2 C.c.	80 minims.
Precipitated Calcium Phosphate	4 Gm.	60 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Oil of Cinnamon with the Precipitated Calcium Phosphate, add the Distilled Water gradually, under continued trituration, and filter.

AQUA CREOSOTI. *U. S.* Creosote Water.

	Metric.	Old form.
Creosote	10 C.c.	154 minims.
Distilled Water	990 C.c.	31 fl. oz. 5¼ fl. dr.
To make	1000 C.c.	2 pints.

Agitate the Creosote vigorously with the Distilled Water, and filter through a well-wetted filter.

AQUA DESTILLATA. *U. S.* Distilled Water.

$H_2O = 17.96.$

	Metric.	Old form.
Water	1000 Vol.	10 pints.
To make	800 Vol.	8 pints.

Distil the Water from a suitable apparatus provided with a block-tin or glass condenser. Collect the first 100 volumes [old form 2 pints], and throw this portion away. Then collect 800 volumes [old form 8 pints], and keep the Distilled Water in glass-stoppered bottles, rinsed with hot Distilled Water immediately before being filled.

AQUA FŒNICULI. *U. S.* Fennel Water.

	Metric.	Old form.
Oil of Fennel	2 C.c.	80 minims.
Precipitated Calcium Phosphate	4 Gm.	60 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Oil of Fennel with the Precipitated Calcium Phosphate, add the Distilled Water gradually, under continued trituration, and filter.

AQUA HYDROGENII DIOXIDI. *U. S.* Solution of Hydrogen Dioxide.

[SOLUTION OF HYDROGEN PEROXIDE.]

A slightly acid, aqueous solution of Hydrogen Dioxide [$H_2O_2 = 33.92$], containing, when freshly prepared, about 3 per cent., by weight, of the pure Dioxide, corresponding to about 10 volumes of available oxygen.

	Metric.	Old form.
Barium Dioxide	300 Gm.	10 oz. av. 7 grains.
Phosphoric Acid,		
Diluted Sulphuric Acid,		
Distilled Water, each, a sufficient quantity.		

Pour 500 C.c. [old form 16 fl. oz.] of cold Distilled Water into a suitable bottle, add to it the Barium Dioxide in such a way that it shall not form lumps, and shake vigorously so that a uniform mixture may result. Provide suitable means of refrigeration, so that the bottle and contents may be kept at a temperature below 10° C. (50° F.), and shake it thoroughly every few minutes during half an hour. Afterwards, continuing the refrigeration, shake it occasionally, but vigorously, until the Dioxide has become fully hydrated, which may be recognized from the fact that only a small portion of the water separates from it on standing, and that it may be mixed with the separated water without great effort by shaking. Having introduced 96 C.c. [old form 3 fl. oz. 34 minims] of Phosphoric Acid into a bottle having the capacity of about 2000 C.c. [old form 4 pints], add to it 320 C.c. [old form 10 fl. oz. 115 minims] of Distilled Water, cool the mixture, and remove 50 C.c. [old form 1 fl. oz. 288 minims] as a reserved portion. Now add the well-mixed magma, in about four portions, to the acid liquid, and mix them intimately by vigorous and continuous shaking, cooling the bottle after each addition of magma. From time to time test the reaction of the liquid, and, when it becomes alkaline, add to it, cautiously, a little of the reserved Phosphoric Acid, until the liquid has again acquired an acid character. Repeat the agitation from time to time, and also the cautious addition of Phosphoric Acid, as long as the liquid becomes alkaline on prolonged, vigorous shaking. If necessary, a further quantity of Phosphoric Acid should be diluted with Distilled Water, in the proportion above given, and a portion of this liquid used for saturation. Having finally shaken the bottle again very thoroughly, and until the liquid part is neutral to litmus paper, set it aside until the precipitate occupies only about one-third

of the volume of the contents, and pour the supernatant liquid upon a wetted, double, rapidly-acting, white filter, of a diameter of thirty centimeters. Then transfer the semi-liquid precipitate to the filter, rinse the bottle with 100 C.c. [old form 3 fl. oz. 96 minims] of Distilled Water, transfer this to the filter, and when the liquid has drained off, wash the barium phosphate on the filter with Distilled Water, until the filtrate measures 1000 C.c. [old form 2 pints]. Now add to it, first, 20 drops, and afterwards, if necessary, further, smaller quantities of Diluted Sulphuric Acid, until a small portion of the liquid, after filtration (which may be assisted by a little starch), is no longer rendered cloudy by Diluted Sulphuric Acid. Mix the cloudy liquid with about 10 Gm. [old form 146 grains] of starch by agitation, so that the starch may be thoroughly distributed throughout the liquid, and then filter it through a well-wetted, white filter of a diameter of twenty-five centimeters, returning the first portions until it runs through clear. When all the liquid has passed, ascertain the percentage of Hydrogen Dioxide contained in it by assay (see Part III.), and dilute the remaining liquid if necessary, so that it will contain 3 per cent. of absolute Hydrogen Dioxide.

Keep the product in loosely-stoppered bottles, in a cool place.

Since Solution of Hydrogen Dioxide will gradually diminish in strength, even when carefully kept, it should either be freshly made when wanted, or be kept on hand only in such quantity as will probably be consumed within a short time. Any Solution which has become weaker need not, for this reason, be thrown away, but may be reserved for an occasion when a weaker or diluted solution is prescribed or demanded. Or it may be employed, when making a fresh supply, as a diluent of the stronger solution.

AQUA MENTHÆ PIPERITÆ. *U. S.* Peppermint Water.

	Metric.	Old form.
Oil of Peppermint	2 C.c.	30 minims.
Precipitated Calcium Phosphate	4 Gm.	60 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Oil of Peppermint with the Precipitated Calcium Phosphate, add the Distilled Water gradually, under constant trituration, and filter.

AQUA MENTHÆ VIRIDIS. *U. S.* Spearmint Water.

	Metric.	Old form.
Oil of Spearmint	2 C.c.	30 minims.
Precipitated Calcium Phosphate	4 Gm.	60 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Oil of Spearmint with the Precipitated Calcium Phosphate, add the Distilled Water gradually, under constant trituration, and filter.

AQUA ROSÆ. *U. S.* Rose Water.

	Old form.
Stronger Rose Water,	
Distilled Water, of each, one volume	8 fl. oz.

Mix them immediately before use.

AQUA ROSÆ FORTIOR. *U. S.* Stronger Rose Water.

[AQUA ROSÆ, PHARM. 1880. TRIPLE ROSE WATER.]

Water saturated with the volatile oil of Rose petals, obtained as a by-product in the distillation of Oil of Rose.

Stronger Rose Water should be kept in well-stoppered bottles, in a dark place.

Stronger Rose Water should be colorless and clear, not mucilaginous, and give no reaction with hydrogen sulphide or ammonium sulphide T. S. (absence of *metallic impurities*).

Liquores. *Solutions:*

Under this head the U. S. Pharmacopœia places all aqueous solutions of non-volatile substances except such as naturally form separate distinctive classes, as the syrups, infusions, and decoctions.

This classification is adopted only in the U. S. Pharmacopœia, the British standard embracing, in addition, gaseous and saccharine solutions, as Liquor Ammoniæ, Liquor Calcis Saccharatus, etc., whilst the German Pharmacopœia does not adopt any definite method, solutions of volatile and non-volatile substances both being in the class Aquæ and also in the class Liquores; Aqua Rosæ and Aqua Plumbi being together, and Liquor Ammonii Caustici and Liquor Natri Caustici being in the same class.

The official solutions constitute a most interesting group of preparations. They are usually very active medicinal agents, and some of them are powerful poisons. The number of official solutions is *twenty-four*. The following tables exhibit in condensed form a view of the class Liquores, U. S. P., arranged alphabetically in two classes. 1. Simple aqueous solutions, in which the solid dissolved is not altered in any respect, except so far as depends upon its external form. 2. Chemical aqueous solutions, or those in which the properties of the dissolved body or bodies are changed by chemical action or heat (see page 199).

LIQUORES, *U. S. P.*

1. Simple Solutions (aqueous).

Name.	Composition.
Liquor Acidi Arsenosi	1 per cent. As_2O_3, 5 per cent. dil. HCl.
Arseni et Hydrargyri Iodidi . . .	1 per cent. AsI_3, 1 per cent. HgI_2.
Calcis	Saturated Solution $Ca(OH)_2$.
Iodi Compositus	5 per cent. I, 10 per cent. KI.
Plumbi Subacetatis Dilutus . . .	3 per cent. Sol. Lead Subacetate.
Potassæ	5.6 per cent. Potassa (second formula).
Sodæ	5.6 per cent. Soda (second formula).
Sodii Arsenatis	1 per cent. dried Sodium Arsenate.
Sodii Silicatis	Nearly Saturated Solution.

2. Chemical Solutions (aqueous).

Name.	Composition.
Liquor Ammonii Acetatis	Dil. Acetic Acid with Ammonium Carbonate.
Ferri Acetatis	Ferric Hydrate with Glacial Acetic Acid and Water (31 per cent. anhydrous Ferric Acetate).
Ferri Chloridi	Iron, HCl, HNO_3, and Distilled Water (37.8 per cent. anhydrous Ferric Chloride).
Ferri Citratis	Ferric Hydrate with Citric Acid and Water (42.5 to 43 per cent. of Scaled Salt).
Ferri et Ammonii Acetatis	Ferric Chloride, Dil. Acetic Acid, Ammonium Acetate, Aromatic Elixir, Glycerin, and Water.
Ferri Nitratis	Ferric Hydrate with Nitric Acid and Water (6.2 per cent. anhydrous Ferric Nitrate).
Ferri Subsulphatis	Ferrous Sulphate, H_2SO_4, HNO_3, Water (13.6 per cent. of Metallic Iron).
Ferri Tersulphatis	Ferrous Sulphate, H_2SO_4, HNO_3, Water (28.7 per cent. of the Salt).
Hydrargyri Nitratis	40 per cent. Red Mercuric Oxide, 45 per cent. Nitric Acid, Water (about 60 per cent. Mercuric Nitrate, and 11 per cent. HNO_3).
Magnesii Citratis	Magnesium Carbonate, Citric Acid, Syrup of Citric Acid, Potassium Bicarbonate, Water.
Plumbi Subacetatis	Lead Acetate, Lead Oxide, Water (about 25 per cent. Lead Subacetate).
Potassæ	Potassium Bicarbonate, Lime, Water (about 5 per cent. Potassa).
Potassii Arsenitis	1 per cent. Arsenous Acid, 2 per cent. Potass. Bicarb., 3 per cent. Compound Tincture of Lavender, Water.
Potassii Citratis	Potassium Bicarbonate, Citric Acid, Water (about 9 per cent. anhydrous Potassium Citrate).
Sodæ	Sodium Carbonate, Lime, Water (about 5 per cent. Sodium Hydrate).
Sodæ Chloratæ	Sodium Carbonate, Chlorinated Lime, Water (at least 2.6 per cent. by weight available Chlorine).
Zinci Chloridi	Zinc, Nitric Acid, Precipitated Zinc Carbonate, HCl, Water (about 50 per cent. by weight Zinc Chloride).

The official solutions vary so greatly in their properties and method of preparation, that no general formula or remarks can be given here to aid the student in studying them individually which would compare in value with the careful consideration that should be given each separate formula. These processes will be found under the head of the bases entering into them in Part III. For general manipulations of solutions, see page 199.

QUESTIONS ON CHAPTER XXI.

AQUEOUS SOLUTIONS.

How may the various forms of official preparations be conveniently classified?

What are the preparations known as waters?

Are any other preparations recognized as waters by the French and German Pharmacopœias?

What various methods have been used for preparing official waters?

How many official waters are there?

What are the medicated waters generally used for?

What is the process of preparing a medicated water from a volatile liquid?

How is a solution of a gas obtained?

How many distilled waters are there?

From what is aqua amygdalæ amaræ prepared, and of what strength is it?

What is the strength of aqua creosoti? Of aqua ammoniæ? Of aqua ammoniæ fortior? Of aqua chlori?

Are the volatile oils generally more soluble in hot or in cold water?

In the preparation of medicated waters, what is the object of passing the liquid through an absorbent powder?

What substance has most generally been used for the purpose?

What is an objection to its use?

What other various substances have been used?

Where solutions of alkaloids or of nitrate of silver are to be made, what should be used?

What substance is used in the official process?

Describe the process.

What is the strength of the following waters: aqua anisi, aqua camphoræ, aqua cinnamomi, aqua fœniculi, aqua menthæ piperitæ, aqua menthæ viridis?

Of the various processes for preparing medicated waters, which is the best?

What precautions should be observed in order to obtain distilled waters of the best quality?

How may a drug be prevented from being injured by heat during distillation?

In distilling rose water or orange flower water, is a naked fire or steam heat preferable, and why?

How may distilled waters be preserved?

Is alcohol useful for the purpose?

What is the objection to it?

What is the strength of orange flower water?

What is the strength of rose water?

Write out in full the Latin name of bitter almond water.

Give the formula and mode of preparing it. Of preparing aqua anisi.

How is orange flower water prepared?

Give the formula and mode of preparing camphor water.

What is chlorine water?

How much chlorine does it contain?

How is it prepared?

Give the formula and mode of preparing cinnamon water. Creosote water.

How is distilled water prepared?

Give the formula and mode of preparing fennel water. Peppermint water.

Write out in full the Latin name of peppermint water. Of spearmint water.

Give the formula and mode of preparing spearmint water.

How is rose water prepared?

What are Liquores of the U. S. P.?

How many official solutions are there?

Into what two classes are solutions divided?

CHAPTER XXII.

AQUEOUS SOLUTIONS CONTAINING SWEET OR VISCID SUBSTANCES.

Syrupi. *Syrups.*

SYRUPS are concentrated solutions of sugar in water or aqueous liquids. The liquids used sometimes contain acetic or other organic acids, and occasionally a small quantity of alcohol. When water *alone* is used in making the solution of sugar, the preparation is termed *syrup*, or *simple syrup*. When the water contains soluble principles from various medicinal substances, the syrup is called a *medicated* syrup. A *flavored syrup* is one which is not medicinal in its action, but which is made by the introduction of various aromatic or pleasantly-flavored substances. Syrups are useful preparations, because their sweet taste facilitates administration, whilst the presence of a large percentage of sugar renders them permanent if they are properly made.

Selection of the Sugar.—The sugar which should be used exclusively in making syrups is clearly defined by the Pharmacopœia. It is described as in white, dry, hard, distinctly crystalline granules, permanent in the air, odorless, having a purely sweet taste, and a neutral reaction. This description corresponds with the sugar known commercially as "granulated," and the official tests prescribed should be carefully observed. (See Saccharum.) The direction that the sugar should be dry is all-important, because the permanency of syrups largely depends upon their containing the correct proportion of sugar and water. If an insufficient amount of sugar is present, the syrups will ferment; if they contain too much, crystallization of the excess takes place at first, whilst the subsequent growth of the crystals is accompanied by an abstraction of sugar from the liquid, and the result is such a weakening of the syrup that fermentation results, as in the first instance. *Damp sugar* should never be used unless the amount of moisture has been carefully ascertained, and an allowance made for it.

Preparation of Syrups.—Syrups are prepared in various ways, and the choice of the proper method must always depend upon the physical and chemical characteristics of the substances entering into the preparation. Five methods are officially recognized, which may be summarized as follows: 1. By solution with heat. 2. By agitation without heat. 3. By the simple addition of a medicating liquid to syrup. 4. By digestion or maceration. 5. By percolation.

1. **By Solution with Heat.**—This is the usual method of making syrups when the valuable constituent is not volatile nor injured by heat, and when it is desirable to make the syrup rapidly. The sugar is usually dissolved in the water or aqueous solution and heated until solution is effected, skimmed, strained, and the proper quantity of water added to make the desired weight or measure. If the syrup is made from an infusion, a decoction, or an aqueous solution containing organic matter, it is usually proper to heat the syrup to the boiling-point, in order to coagulate albuminous matter: this is separated subsequently by straining. If the albumen or other impurities were suffered to remain in the syrup, fermentation would probably be induced in warm weather. Saccharometers (see page 83) are very useful in making syrups by the hot process where the specific gravity of the finished syrup is known. This instrument may be floated in the syrup *whilst boiling*, and thus the exact degree of concentration determined without waiting to cool the syrup and having to heat it again subsequently to concentrate it further.

2. **By Agitation without Heat.**—This process is directed by the Pharmacopœia to be used in those cases where there is likelihood of loss of valuable volatile constituents. It is the principal cold process adopted by the Pharmacopœia. The aqueous solution is usually directed to be added to the sugar in a bottle, and the whole well shaken together until the sugar is dissolved. This is best effected by allowing the tightly-corked bottle to lie upon its side during the intervals of agitation.

3. **By the Simple Addition of Medicating Liquid to Syrup.**—This method is resorted to in those cases in which fluid extracts, tinctures, or other liquids are added to syrup in order to medicate it. Syrups made in this way usually show precipitates in time, owing to the fact that alcohol enters into most of the liquids thus used, and the resinous and oily substances dissolved by the alcohol often precipitate when mixed with the syrup, producing unsightly preparations.

4. **By Maceration or Digestion.**—But one official syrup is made by digestion,—*i.e.*, syrup of tolu. This method, as shown in this preparation, is not recommended as either accurate or efficient. A solution of a comparatively insoluble substance, like balsam of tolu, can always be effected in a more rapid and thorough manner by dissolving the substance in alcohol, mixing the tincture with sugar, and then getting rid of the alcohol subsequently by evaporation, or by the simpler and better method of suspending the resinous tincture in a mixture of magnesium carbonate and water, filtering, and retaining the small proportion of alcohol in the finished syrup. The process of maceration *without* digestion is used in making the official syrup of tar, and consists simply in stirring the purified tar with boiling distilled water, macerating for thirty-six hours, decanting the solution, and filtering.

5. **Percolation in making Syrups.**—This method originated with Orynski, and is conducted as follows. Into the lower orifice of an ordinary percolator is introduced a small piece of sponge, the sugar (granulated) is then poured in, and upon this the water, the apparatus being arranged as is usual in the process of percolation. The percolator may be covered loosely, and the operation will proceed without further attention, the syrup coming through drop by drop. If it should be

necessary to use crushed sugar, the percolator must be corked at the lower orifice, and the sugar and water introduced and allowed to macerate until the former has dissolved down to *half its bulk*, when the cork may be removed and the liquid be allowed to drop. If, after the liquid has all passed, there remains a quantity of undissolved sugar in the percolator, enough percolate may be poured back to dissolve it, afterwards adding sufficient water to bring the whole up to the required measure.

To be successful in using this process, care in several particulars must be exercised: 1. The percolator used should be cylindrical or semi-cylindrical, and cone-shaped as it nears the lower orifice. 2. The sugar must be coarse, else it will form into a compact mass, which the liquid cannot permeate. 3. The sponge must be introduced with care. If pressed too tightly in, it will effectually stop the process; if inserted too loosely, the liquid will pass too rapidly, and will, in consequence, be weak and turbid (from imperfect filtration).

Preservation of Syrups.—Syrups should never be made in larger quantities than can be used within a few months, except in those cases where special facilities can be employed for their preservation. A low temperature is the best preservative for syrups: concentration without supersaturation is also a condition favorable to preservation. The addition of substances like boric acid or salicylic acid, alcohol, calcium sulphite, etc., to prevent the fermentation of syrups, is not recommended, for if used in sufficient quantity to act as preservatives they communicate their own flavor to the syrup, or are otherwise objectionable. The practice of restoring syrups which have been spoiled through fermentation by heating them and "working them over" is a reprehensible one. The practice of good pharmacy demands the possession of sufficient moral courage to find a place for fermented syrups where they will do the least harm,—*i.e.*, in the sink and gutter-pipe.

A simple and practical method of preserving syrups, which is very effective, is as follows. A number of bottles are provided holding not more than a pint each, even when the quantity of syrup is large; the bottles are thoroughly cleaned, and kept hot by immersion in boiling water until ready for use; and a sufficient number of good corks, which have been thoroughly soaked in hot water, and of the proper size for the bottles, should be at hand. The syrup should be heated to the boiling-point (strained, if necessary, and reheated), and poured into the hot bottles until they are filled to the brim. The corks are inserted by forcibly pressing them into the necks of the bottles, thereby displacing a small portion of the syrup, and are tied down with twine in the usual manner. Then, whilst the necks of the bottles are still hot (and before the syrup can contract in volume through cooling) they are dipped into melted sealing-wax contained in a suitable vessel. By this method the germs which are supposed to produce fermentation are destroyed by the heat, and no air can find its way to the syrup, as the bottles are hermetically sealed. Fruit-juices may be preserved in the same way.

Official Syrups.—There are THIRTY-TWO official syrups. Of this number FOUR are made by *solution with heat*, FOURTEEN by the *simple addition of medicating liquid to syrup*, THIRTEEN by *agitation of the sugar with the medicating liquid without heat*, and ONE by *maceration or digestion*,

Table of Official Syrups, arranged in Classes according to the Methods employed in their Preparation.

Name and Method of Preparation.	Sub-Classes.	Proportions.
Solution with Heat.		
Syrupus.		850 Gm. Sugar; Distilled Water to 1000 C.c.
Calcis.		65 Gm. Lime; 400 Gm. Sugar; Water to 1000 C.c.
Ferri Iodidi.	Solution involving chemical action preserved by sugar.	(Containing 10 p.c. Ferrous Iodide.) 25 Gm. Iron Wire; 83 Gm. Iodine; Syrup, Distilled Water, to 1000 Gm.
Rubi Idæi.	From clarified raspberry juice.	Fresh ripe Raspberries and Sugar.
Scillæ.	Containing acetic acid.	450 C.c. Vinegar of Squill; 800 Gm. Sugar; Water to 1000 C.c.
Simple Addition of Medicating Liquid to Syrup.		
Syrupus Acaciæ.	With mucilage.	250 C.c. Mucilage; Syrup to 1000 C.c.
Acidi Citrici.	With flavored acidulated solution.	10 Gm. Citric Acid; 10 C.c. Water; 10 C.c. Spirit of Lemon; Syrup to 1000 C.c.
Rhei Aromaticus.	With aromatic tincture.	150 C.c. Aromatic Tincture of Rhubarb; 850 C.c. Syrup.
Tolutanus.	With strong tincture.	10 Gm. Balsam of Tolu; 50 Gm. Precipitated Calcium Phosphate; 850 Gm. Sugar; 50 C.c. Alcohol; Water to 1000 C.c.
Lactucarii.	With tincture.	100 C.c. Tincture of Lactucarium; 50 Gm. Precipitated Calcium Phosphate; 750 Gm. Sugar; Water to 1000 C.c.
Ipecacuanhæ.	With fluid extract.	70 C.c. Fluid Extract of Ipecac; 10 C.c. Acetic Acid; 100 C.c. Glycerin; 700 Gm. Sugar; Water to 1000 C.c.
Krameriæ.	" "	450 C.c. Fluid Extract of Krameria; 550 C.c. Syrup.
Rhei.	" "	100 C.c. Fluid Extract of Rhubarb; 4 C.c. Spirit of Cinnamon; 10 Gm. Potassium Carbonate; 50 C.c. Glycerin; 50 C.c. Water; Syrup to 1000 C.c.
Rosæ.	" "	125 C.c. Fluid Extract of Rose; 875 C.c. Syrup.
Rubi.	" "	250 C.c. Fluid Extract of Rubus; 750 C.c. Syrup.
Sarsaparillæ Compositus.	" "	200 C.c. Fluid Extract of Sarsaparilla; 15 C.c. Fluid Extract of Glycyrrhiza; 15 C.c. Fluid Extract of Senna; 650 Gm. Sugar; 0.1 C.c. Oil of Sassafras; 0.1 C.c. Oil of Anise; 0.1 C.c. Oil of Gaultheria; Water to 1000 C.c.
Scillæ Compositus.	Medicated water from tincture.	80 C.c. Fluid Extract of Squill; 80 C.c. Fluid Extract of Senega; 2 Gm. Antimony and Potassium Tartrate; 10 Gm. Precipitated Calcium Phosphate; 750 Gm. Sugar; Water to 1000 C.c.
Senegæ.	" "	200 C.c. Fluid Extract of Senega; 5 C.c. Ammonia Water; 700 Gm. Sugar; Water to 1000 C.c.
Zingiberis.	Medicated water from fluid extract.	80 C.c. Fluid Extract of Ginger; 15 Gm. Precipitated Calcium Phosphate; 850 Gm. Sugar; Water to 1000 C.c.

Table of Official Syrups, etc.—(*Continued.*)

Name and Method of Preparation.	Sub-Classes.	Proportions.
Agitation of Sugar with Medicating Liquid or simple admixture without Heat.		
Syrupus Allii.	Containing acetic acid.	200 Gm. Fresh Garlic; 800 Gm. Sugar; Diluted Acetic Acid to 1000 C.c.
Althææ.	From cold aqueous infusion.	50 Gm. Althæa; 30 C.c. Alcohol; 100 C.c. Glycerin; 700 Gm. Sugar; Water to 1000 C.c.
Pruni Virginianæ.	" "	150 Gm. Wild Cherry; 700 Gm. Sugar; 150 C.c. Glycerin; Water to 1000 C.c.
Sennæ.	From infusion in boiling water.	250 Gm. Alexandria Senna; 5 C.c. Oil of Coriander; 150 C.c. Alcohol; 700 Gm. Sugar; Water to 1000 C.c.
Amygdalæ.	From emulsion.	140 Gm. Sweet Almond; 40 Gm. Bitter Almond; 200 Gm. Sugar; 100 C.c. Orange Flower Water; 130 C.c. Water; Syrup to 1000 C.c.
Aurantii.	Medicated water from tincture.	50 Gm. Sweet Orange Peel; 50 Gm. Precipitated Calcium Phosphate; 700 Gm. Sugar; Alcohol, Water, to 1000 C.c.
Aurantii Florum.	Simple admixture or solution.	850 Gm. Sugar; Orange Flower Water, to make 1000 C.c.
Ferri Quininæ et Strychninæ Phosphatum.	" "	20 Gm. Soluble Ferric Phosphate; 30 Gm. Quinine Sulphate; 0.2 Gm. Strychnine; 48 C.c. Phosphoric Acid; 100 C.c. Glycerin; 50 C.c. Water; Syrup to 1000 C.c.
Hypophosphitum.	" "	45 Gm. Calcium Hypophosphite; 15 Gm. Potassium Hypophosphite; 15 Gm. Sodium Hypophosphite; 2 Gm. Diluted Hypophosphorous Acid; 500 Gm. Sugar; 5 C.c. Spirit of Lemon; Water to 1000 C.c.
Hypophosphitum cum Ferro.	" "	10 Gm. Ferrous Lactate; 10 Gm. Potassium Citrate; Syrup of Hypophosphites to 1000 C.c.
Acidi Hydriodici.	Solution involving chemical reaction.	(Containing 1 p.c. Absolute Hydriodic Acid.) 13 Gm. Potassium Iodide; 1 Gm. Potassium Hypophosphite; 12 Gm. Tartaric Acid; 15 C.c. Water; Diluted Alcohol, Syrup, to 1000 Gm.
Calcii Lactophosphatis.	" "	60 C.c. Lactic Acid; 36 C.c. Phosphoric Acid; 25 C.c. Orange Flower Water; 25 Gm. Precipitated Calcium Carbonate; 700 Gm. Sugar; Water to 1000 C.c.
By Maceration or Digestion.		
Syrupus Picis Liquidæ.		75 Gm. Tar; 150 C.c. Water; 400 C.c. Boiling Distilled Water; 100 C.c. Glycerin; 800 Gm. Sugar; Distilled Water to 1000 C.c.

SYRUPUS. *U.S.* **Syrup.**

	Metric.	Old form.
Sugar, in coarse powder	850 Gm.	7 ℔. 1½ oz. av.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Dissolve the Sugar, with the aid of heat, in 450 C.c. [old form 58 fl. oz.] of Distilled Water, raise the temperature to the boiling point, strain the liquid, and pass enough Distilled Water through the strainer to make the product, when cold, measure 1000 C.c. [old form 8 pints]. Mix thoroughly.

Syrup may also be prepared in the following manner:

Press down into the neck of a percolator or funnel of suitable size a tapering piece of coarse, well-cleaned sponge, not too tightly, and in such a manner that the whole sponge shall be within the neck of the percolator, its upper end being about half an inch below its commencement. Place the Sugar in the apparatus, make its surface level without shaking or jarring, then carefully pour on 450 C.c. [old form 58 fl. oz.] of Distilled Water, and regulate the flow of the liquid, if necessary, so that it will pass out in rapid drops. Return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Distilled Water, added in portions, so that all the Sugar may be dissolved, and the product measure 1000 C.c. [old form 8 pints]. Mix thoroughly.

Syrup thus prepared has a specific gravity of about 1.317.

SYRUPUS ACACIÆ. *U.S.* Syrup of Acacia.

	Metric.	Old form.
Mucilage of Acacia, recently prepared	25 C.c.	1 fl. oz.
Syrup	75 C.c.	3 fl. oz.
To make	100 C.c.	4 fl. oz.

Mix them.

This syrup should be freshly prepared, when required.

SYRUPUS ACIDI CITRICI. *U.S.* Syrup of Citric Acid.

	Metric.	Old form.
Citric Acid	10 Gm.	146 grains.
Water	10 C.c.	2½ fl. dr.
Spirit of Lemon	10 C.c.	2½ fl. dr.
Syrup, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Citric Acid in the Water, and mix the solution with 500 C.c. [old form 1 pint] of Syrup. Then add the Spirit of Lemon, and, lastly, enough Syrup to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS ACIDI HYDRIODICI. *U.S.* Syrup of Hydriodic Acid.

A syrupy liquid containing about 1 per cent., by weight, of absolute Hydriodic Acid [$HI = 127.53$], or about 1.3 Gm. in 100 C.c.

	Metric.	Old form.
Potassium Iodide	13 Gm.	250 grains.
Potassium Hypophosphite	1 Gm.	19 grains.
Tartaric Acid	12 Gm.	231 grains.
Water	15 C.c.	5 fl. dr.
Diluted Alcohol,		
Syrup, each, a sufficient quantity,		
To make	1000 Gm.	2 pints.

Dissolve the two Potassium salts in the Water, and the Tartaric Acid in 25 C.c. [old form 1 fl. oz.] of Diluted Alcohol. Mix the two solutions in a vial, shake it thoroughly, and place it in ice-water for half an hour, occasionally shaking. Then filter the mixture through a small, rapidly-acting, white filter, and carefully wash the vial and filter with Diluted Alcohol, until the filtrate ceases to produce more than a faint cloudiness when a drop or two is allowed to fall into silver nitrate test-solution. Reduce the filtrate, by evaporation in a tared capsule, on a water-bath, to 50 Gm. [old form 960 grains], and mix it, when cold, with enough Syrup to make the product weigh 1000 Gm. [old form 2 pints].

A transparent, colorless, or not more than pale straw-colored liquid, odorless, and having a sweet and acidulous taste.

Specific gravity: about 1.313 at 15° C. (59° F.).

If a small portion of the Syrup be mixed with a little starch T.S., and a few drops of chlorine water then added, the liquid will acquire a deep blue color. Not more than a faint bluish tint should be produced in the Syrup by starch T.S. alone (limit of *free iodine*).

The addition of silver nitrate T.S. to a small portion of the Syrup produces a pale yellow precipitate, nearly insoluble in ammonia water.

If 32 (31.88) Gm. of the Syrup be exactly neutralized by ammonia water, and then mixed with 2 drops of potassium chromate T.S., it should require about 25 C.c. of decinormal silver nitrate V.S. to produce a permanent red tint (corresponding to about 1 per cent. of absolute Hydriodic Acid).

SYRUPUS ALLII. *U. S.* Syrup of Garlic.

	Metric.	Old form.
Fresh Garlic, sliced and bruised	200 Gm.	6 oz. av. 296 gr.
Sugar	800 Gm.	26 oz. av. 308 gr.
Diluted Acetic Acid, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Macerate the Garlic with 300 C.c. [old form 9½ fl. oz.] of Diluted Acetic Acid during four days, and express the liquid, avoiding the use of metallic utensils. Then mix the residue with 200 C.c. [old form 6¾ fl. oz.] more of Diluted Acetic Acid, and again express. Mix the expressed liquids, and filter. Pour the filtrate upon the Sugar, contained in a suitable vessel, and stir or agitate until the Sugar is dissolved. Lastly, add enough Diluted Acetic Acid to make the product measure 1000 C.c. [old form 2 pints], and mix thoroughly.

Keep the Syrup in well-stoppered, completely filled bottles, in a cool place.

Syrup of Garlic may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Diluted Acetic Acid, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS ALTHÆÆ. *U. S.* Syrup of Althæa.

	Metric.	Old form.
Althæa, cut into small pieces	50 Gm.	1 oz. av. 293 gr.
Alcohol	30 C.c.	460 minims.
Glycerin	100 C.c.	3 fl. oz. 96 min.
Sugar	700 Gm.	23 oz. av. 160 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Wash the Althæa with cold Water, then macerate it with 400 C.c. [old form 13 fl. oz.] of Water previously mixed with the Alcohol, during one hour, stirring frequently, and strain without expressing the residue. In the strained liquid dissolve the Sugar by agitation, without heat, add the Glycerin, and enough Water to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Keep the Syrup in well-stoppered, completely filled bottles, in a cool place.

SYRUPUS AMYGDALÆ. *U. S.* Syrup of Almond.

	Metric.	Old form.
Sweet Almond	140 Gm.	4 oz. av. 295 gr.
Bitter Almond	40 Gm.	1 oz. av. 147 gr.
Sugar	200 Gm.	6 oz. av. 296 gr.
Orange Flower Water	100 C.c.	3 fl. oz. 96 min.
Water	200 C.c.	6 fl. oz. 192 min.
Syrup, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Rub the Almonds, previously blanched, in a mortar with 100 Gm. [old form 3 oz. av. 148 gr.] of the Sugar and 30 C.c. [old form 1 fl. oz.] of Water to a smooth paste. Mix this well with the Orange Flower Water and 200 C.c. [old form 6 fl. oz. 192 min.] of Water, and strain with strong expression. To the residue add 100 C.c. [old form 3 fl. oz. 96 min.] of Water, and express again. In the strained liquid dissolve the remainder of the Sugar, without heat, adding enough Water to make the product measure 1000 C.c. [old form 2 pints].

Keep the Syrup in well-stoppered, completely filled bottles, in a cool place.

SYRUPUS AURANTII. *U. S.* Syrup of Orange.

	Metric.	Old form.
Sweet Orange Peel, taken from the fresh fruit	50 Gm.	1 oz. av. 293 gr.
Precipitated Calcium Phosphate	50 Gm.	1 oz. av. 293 gr.
Sugar	700 Gm.	23 oz. av. 160 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Introduce the Sweet Orange Peel (which should be as free as possible from the white, inner layer, and cut into small shreds) into a flask, and add 80 C.c. [old form 2½ fl. oz.] of Alcohol. Stopper the flask loosely with a notched cork, apply the heat of a water-bath until the Alcohol boils, and maintain it boiling during five minutes. Then stopper the flask well, and set it aside to cool. Filter off the liquid, and wash the filter and contents with Alcohol until the filtrate measures 100 C.c. [old form 3 fl. oz.]. Mix the Precipitated Calcium Phosphate, in a mortar, with 150 Gm. [old form 5 oz. av.] of Sugar, and add the tincture with constant trituration. To the resulting, pasty mass add 300 C.c. [old form 9½ fl. oz.] of Water, triturating constantly, transfer the whole to a filter, and return the first portions of the filtrate, if necessary, until it runs through clear. In the filtrate dissolve the remainder of the Sugar, and add enough Water, through the filter, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS AURANTII FLORUM. *U.S.* Syrup of Orange Flowers.

	Metric.	Old form.
Sugar	850 Gm.	28 oz. av. 164 gr.
Orange Flower Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Sugar in 450 C.c. [old form 14½ fl. oz.] of Orange Flower Water by agitation, without heat, add enough Orange Flower Water to make the product measure 1000 C.c. [old form 2 pints], and mix thoroughly.

Syrup of Orange Flowers may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour 450 C.c. [old form 14½ fl. oz.] of Orange Flower Water upon the Sugar, return the first portions of the percolate until it runs through clear, and, when all the liquid has passed, follow it by Orange Flower Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS CALCII LACTOPHOSPHATIS. *U.S.* Syrup of Calcium Lactophosphate.

	Metric.	Old form.
Precipitated Calcium Carbonate	25 Gm.	365 grains.
Lactic Acid	60 C.c.	1 fl. oz. 442 min.
Phosphoric Acid	36 C.c.	1 fl. oz. 72 min.
Orange Flower Water	25 C.c.	384 minims.
Sugar	700 Gm.	23 oz. av. 160 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Lactic Acid mixed with 100 C.c. [old form 3 fl. oz. 96 min.] of Water, and contained in a capacious mortar, gradually add the Calcium Carbonate, in portions, until it is dissolved. Then add the

Phosphoric Acid, and triturate until the precipitate at first formed is dissolved. Add 150 C.c. [old form 4 fl. oz. 6 fl. dr.] of Water, and filter, rinsing the mortar with 75 C.c. [old form 2½ fl. oz.] of Water, and passing the rinsings through the filter. To the mixed filtrates add the Orange Flower Water, and, having added the Sugar, dissolve it by agitation, without heat, and strain. Lastly, pass enough water through the strainer to make the product measure 1000 C.c. [old form 2 pints], and mix thoroughly.

SYRUPUS CALCIS. *U. S.* Syrup of Lime.

	Metric.	Old form.
Lime	65 Gm.	2 oz. av. 74 gr.
Sugar	400 Gm.	18 oz. av. 154 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Lime and Sugar thoroughly in a mortar, so as to form a homogeneous powder; then add the mixture to 500 C.c. [old form 1 pint] of boiling Water, contained in a bright copper or tinned iron vessel, boil for five minutes, constantly stirring, and then strain. Dilute the strained liquid with an equal volume of Water, and filter through white paper. Then evaporate the filtrate, in a tared capsule, to 700 Gm. [old form 23 oz. av. 160 gr.], allow it to cool, add to it enough Water to make the product measure 1000 C.c. [old form 2 pints], and mix thoroughly.

Keep the Syrup in well-stoppered bottles.

SYRUPUS FERRI IODIDI. *U. S.* Syrup of Ferrous Iodide.

A syrupy liquid containing about 10 per cent., by weight, of Ferrous Iodide [$FeI_2 = 308.94$], or about 18.4 Gm. in 100 C.c.

	Metric.	Old form.
Iron, in the form of fine bright wire, and cut into small pieces	25 Gm.	495 grains.
Iodine	83 Gm.	3 oz. av. 328 gr.
Syrup,		
Distilled Water, each, a sufficient quantity,		
To make	1000 Gm.	2 pints.

Introduce the Iron into a flask of thin glass, having a capacity of about 500 C.c. [old form 1 pint], add to it 150 C.c. [old form 5 fl. oz.] of Distilled Water, and afterwards the Iodine. Shake the mixture occasionally, checking the reaction, if necessary, by the affusion of cold water, and, when the solution has acquired a greenish color, and has lost the odor of Iodine, heat it to boiling. Then filter it through a strong, double, rapidly-acting filter placed in a funnel, the point of which dips below the surface of 600 Gm. [old form 19 fl. oz.] of Syrup contained in a tared vessel. When the liquid has run through, wash the flask, and filter with a mixture of 25 C.c. [old form 1 fl. oz.], each, of Syrup and Distilled Water, previously raised to near 100° C.

(212° F.), then withdraw the funnel, add enough Syrup to make the product weigh 1000 Gm. [old form 2 pints], and mix thoroughly.

Keep the Syrup in small, well-stoppered, and completely filled bottles.

A transparent, pale green liquid, having a sweet, strongly ferruginous taste, and a neutral reaction.

Specific gravity: about 1.353 at 15° C. (59° F.).

On adding a few drops of potassium ferricyanide T.S. to a small portion of the Syrup, a blue precipitate will be produced.

If mixed with a little starch T.S., and afterwards with a few drops of chlorine water, the Syrup will acquire a deep blue color. This color should not be produced in the Syrup by starch T.S. alone (absence of *free iodine*).

If 1.55 Gm. (1.5447 Gm.) of the Syrup and 10 C.c. of water be introduced into a flask, and the liquid mixed, successively, with 11 C.c. of decinormal silver nitrate V.S. and 5 C.c., each, of diluted nitric acid and ferric ammonium sulphate T.S., it should not require more than about 1 C.c. of decinormal potassium sulphocyanate V.S. to produce a reddish-brown tint which persists after shaking (corresponding to about 10 per cent. of Ferrous Iodide).

SYRUPUS FERRI, QUININÆ ET STRYCHNINÆ PHOSPHATUM. *U. S.*

Syrup of the Phosphates of Iron, Quinine, and Strychnine.

	Metric.	Old form.
Soluble Ferric Phosphate	20 Gm.	292 grains.
Quinine Sulphate	30 Gm.	438 grains.
Strychnine	0.2 Gm.	3 grains.
Phosphoric Acid	48 C.c.	1 fl. oz. 258 min.
Glycerin	100 C.c.	3 fl. oz. 96 min.
Water	50 C.c.	1 fl. oz. 288 min.
Syrup, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Heat the Soluble Ferric Phosphate with the Water, in a porcelain capsule, until it is dissolved. Then add the Phosphoric Acid, the Quinine Sulphate, and the Strychnine, and stir, until solution is effected. Filter the liquid into the Glycerin, contained in a graduated bottle, add enough Syrup to make up the volume to 1000 C.c. [old form 2 pints], and mix thoroughly. Lastly, strain, if necessary.

SYRUPUS HYPOPHOSPHITUM. *U. S.* Syrup of Hypophosphites.

	Metric.	Old form.
Calcium Hypophosphite	45 Gm.	660 grains.
Potassium Hypophosphite	15 Gm.	220 grains.
Sodium Hypophosphite	15 Gm.	220 grains.
Diluted Hypophosphorous Acid	2 Gm.	30 minims.
Sugar	500 Gm.	16 oz. av. 300 gr.
Spirit of Lemon	5 C.c.	76 minims.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Hypophosphites with 450 C.c. [old form 14½ fl. oz.] of Water, until they are dissolved, add the Spirit of Lemon, and the Hypophosphorous Acid, and filter the liquid. In the filtrate dissolve

the Sugar by agitation, without heat, and add enough Water, through the filter, to make the product measure 1000 C.c. [old form 2 pints]. Strain, if necessary.

Syrup of Hypophosphites may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS HYPOPHOSPHITUM CUM FERRO. *U.S.* **Syrup of Hypophosphites with Iron.**

	Metric.	Old form.
Ferrous Lactate	10 Gm.	146 grains.
Potassium Citrate	10 Gm.	146 grains.
Syrup of Hypophosphites, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Rub the Ferrous Lactate and Potassium Citrate with a small quantity of the Syrup, gradually added, until they are dissolved. Then strain, and add enough Syrup of Hypophosphites to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

This preparation should be freshly made, when wanted.

SYRUPUS IPECACUANHÆ. *U.S.* **Syrup of Ipecac.**

	Metric.	Old form.
Fluid Extract of Ipecac	70 C.c.	2 fl. oz. 115 min.
Acetic Acid	10 C.c.	158 minims.
Glycerin	100 C.c.	3 fl. oz. 96 min.
Sugar	700 Gm.	28 oz. av. 160 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dilute the Fluid Extract of Ipecac with 300 C.c. [old form 9½ fl. oz.] of Water to which the Acetic Acid had previously been added, and mix them thoroughly by shaking. Then filter, and pass enough water through the filter to obtain 500 C.c. [old form 1 pint] of filtrate. To this liquid add the Glycerin, dissolve the Sugar in the mixture, and add enough Water to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly, and strain, if necessary.

Syrup of Ipecac may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Mix the filtrate obtained as directed in the preceding formula with the Glycerin, pour the mixture upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS KRAMERIÆ. *U. S.* Syrup of Krameria.

	Metric.	Old form.
Fluid Extract of Krameria	450 C.c.	14 fl. oz. 3 fl. dr.
Syrup	550 C.c.	17 fl. oz. 5 fl. dr.
To make	1000 C.c.	2 pints.

Mix them.

SYRUPUS LACTUCARII. *U. S.* Syrup of Lactucarium.

	Metric.	Old form.
Tincture of Lactucarium	100 C.c.	3 fl. oz. 96 min.
Precipitated Calcium Phosphate	50 Gm.	1 oz. av. 300 gr.
Sugar	750 Gm.	25 oz. av.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Precipitated Calcium Phosphate and 150 Gm. [old form 5 oz. av.] of the Sugar, in a mortar, with the Tincture of Lactucarium gradually added, and afterwards with 300 C.c. [old form 10 fl. oz.] of Water, added in small portions at a time. Filter the mixture, dissolve the remainder of the Sugar in the filtrate, and pass enough Water through the filter to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Syrup of Lactucarium may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS PICIS LIQUIDÆ. *U. S.* Syrup of Tar.

	Metric.	Old form.
Tar	75 Gm.	2½ oz. av.
Water	150 C.c.	5 fl. oz.
Boiling Distilled Water	400 C.c.	13 fl. oz.
Glycerin	100 C.c.	3 fl. oz. 96 min.
Sugar	800 Gm.	26 oz. av. 300 gr.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Tar intimately with about 100 Gm. [old form 3 oz. av.] of white sand, pour on the Water, and stir frequently during twelve hours; then pour off the Water and throw it away. Pour the Boiling Distilled Water upon the residue, stir well and frequently during fifteen minutes, add the Glycerin, and set the vessel aside for twenty-four hours, occasionally stirring. Decant the clear solution, and filter. Dissolve the Sugar in the filtrate with the aid of a gentle heat; allow the liquid to cool, then strain it, and pass enough Distilled Water

through the strainer to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS PRUNI VIRGINIANÆ. *U.S.* **Syrup of Wild Cherry.**

	Metric.	Old form.
Wild Cherry, in No. 20 powder	150 Gm.	5 oz. av.
Sugar	700 Gm.	28 oz. av. 160 gr.
Glycerin	150 C.c.	5 fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Glycerin with 300 C.c. [old form 9½ fl. oz.] of Water. Moisten the Wild Cherry with a sufficient quantity of the liquid, and macerate for twenty-four hours in a close vessel; then pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid has disappeared from the surface, follow it by Water, until the percolate measures 450 C.c. [old form 14½ fl. oz.]. Dissolve the Sugar in the percolate by agitation, without heat, strain, and pass enough Water through the strainer to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Syrup of Wild Cherry may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the percolate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS RHEI. *U.S.* **Syrup of Rhubarb.**

	Metric.	Old form.
Fluid Extract of Rhubarb	100 C.c.	3 fl. oz. 96 min.
Spirit of Cinnamon	4 C.c.	1 fl. dr.
Potassium Carbonate	10 Gm.	146 grains.
Glycerin	50 C.c.	1 fl. oz. 288 min.
Water	50 C.c.	1 fl. oz. 288 min.
Syrup, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Spirit of Cinnamon with the Fluid Extract of Rhubarb, and add to it the Potassium Carbonate dissolved in the Water. Then add the Glycerin, and, lastly, enough Syrup to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS RHEI AROMATICUS. *U.S.* **Aromatic Syrup of Rhubarb.**

	Metric.	Old form.
Aromatic Tincture of Rhubarb	150 C.c.	4¾ fl. oz.
Syrup	850 C.c.	27¼ fl. oz.
To make	1000 C.c.	2 pints.

Mix them.

SYRUPUS ROSÆ. *U. S.* Syrup of Rose.

	Metric.	Old form.
Fluid Extract of Rose	125 C.c.	4 fl. oz.
Syrup	875 C.c.	28 fl. oz.
To make	1000 C.c.	2 pints.

Mix them.

SYRUPUS RUBI. *U. S.* Syrup of Rubus.

	Metric.	Old form.
Fluid Extract of Rubus	250 C.c.	8 fl. oz.
Syrup	750 C.c.	24 fl. oz.
To make	1000 C.c.	2 pints.

Mix them.

SYRUPUS RUBI IDÆI. *U. S.* Syrup of Raspberry.

Fresh, Ripe Raspberries, any convenient quantity,
Sugar, a sufficient quantity.

Reduce the Raspberries to a pulp, and let this stand, at a temperature of about 20° C. (68° F.), until a small portion of the filtered juice mixes clear with half its volume of alcohol. Then separate the juice by pressing, set it aside, in a cool place, until the liquid portion has become clear, and filter. To every 40 parts by weight of the filtrate (which should not be allowed to remain, unprotected by sugar, more than about two hours) add 60 parts of Sugar, heat the mixture to boiling, avoiding the use of tinned vessels, and strain. Keep the product in well-stoppered bottles, in a cool and dark place.

On shaking separate portions of Syrup of Raspberries with ether, chloroform, or amylic alcohol, no color should be imparted to these liquids (absence of *foreign coloring matters*).

SYRUPUS SARSAPARILLÆ COMPOSITUS. *U. S.* Compound Syrup of Sarsaparilla.

	Metric.	Old form.
Fluid Extract of Sarsaparilla	200 C.c.	6½ fl. oz.
Fluid Extract of Glycyrrhiza	15 C.c.	½ fl. oz.
Fluid Extract of Senna	15 C.c.	½ fl. oz.
Sugar	650 Gm.	21 oz. av. 305 gr.
Oil of Sassafras	0.1 C.c.	2 drops.
Oil of Anise	0.1 C.c.	2 drops.
Oil of Gaultheria	0.1 C.c.	2 drops.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Add the Oils (equivalent to about 2 drops, each) to the mixed Fluid Extracts, and shake the liquid thoroughly. Then add enough Water to make up the volume to 600 C.c. [old form 19 fl. oz.], and mix well. Set the mixture aside for one hour, then filter it. Dissolve the sugar in the filtrate with the aid of a gentle heat, allow the liquid to cool, strain, and add enough Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS SCILLÆ. *U. S.* Syrup of Squill.

	Metric.	Old form.
Vinegar of Squill	450 C c.	14½ fl. oz.
Sugar	800 Gm.	26 oz. av. 308 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Heat the Vinegar of Squill to the boiling point, in a glass or porcelain vessel, and filter the liquid while it is hot. Dissolve the Sugar in the hot filtrate by agitation, without further heating, strain, and, when the strained liquid is cold, add enough Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS SCILLÆ COMPOSITUS. *U. S.* Compound Syrup of Squill.

	Metric.	Old form.
Fluid Extract of Squill	80 C.c.	2 fl. oz. 4½ fl. dr.
Fluid Extract of Senega	80 C.c.	2 fl. oz. 4½ fl. dr.
Antimony and Potassium Tartrate	2 Gm.	29 grains.
Precipitated Calcium Phosphate	10 Gm.	146 grains.
Sugar	750 Gm.	25 oz. av.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Fluid Extracts, evaporate them, in a tared capsule, on a water-bath, to 100 Gm. [old form 3 fl. oz.], and mix the residue with 350 C.c. [old form 11 fl. oz.] of Water. When the mixture is cold, incorporate with it, intimately, the Precipitated Calcium Phosphate, filter, pass enough Water through the filter to obtain 400 C.c. [old form 12 fl. oz. 6½ fl. dr.] of filtrate, and add to this the Antimony and Potassium Tartrate dissolved in 25 C.c. [old form 6 fl. dr.] of hot Water. Dissolve the Sugar in this liquid by agitation, without heat, strain, and add enough Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Compound Syrup of Squill may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula, and mixed with the solution of Antimony and Potassium Tartrate, upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS SENEGÆ. *U. S.* Syrup of Senega.

	Metric.	Old form.
Fluid Extract of Senega	200 C.c.	6 fl. oz. 192 min.
Ammonia Water	5 C c.	76 minims.
Sugar	700 Gm.	23 oz. av. 160 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Fluid Extract of Senega with 300 C.c. [old form 9½ fl. oz.] of Water and with the Ammonia Water, and set the mixture aside for a few hours. Then filter, and pass enough Water through the filter to obtain 550 C.c. [old form 17½ fl. oz.]. In the filtrate dissolve the Sugar by agitation, without heat, strain, and add enough Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Syrup of Senega may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS SENNÆ. *U. S.* Syrup of Senna.

	Metric.	Old form.
Senna (Alexandria), bruised	250 Gm.	8 oz. av. 150 gr.
Oil of Coriander	5 C.c.	76 minims.
Alcohol	150 C.c.	4 fl. oz. 6¼ fl. dr.
Sugar	700 Gm.	23 oz. av. 160 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Senna add 700 C.c. [old form 22½ fl. oz.] of boiling Water, and digest, at a temperature not exceeding 60° C. (140° F.), during twenty-four hours. Then express the liquid, and pass enough Water through the residue to obtain 600 C.c. [old form 19 fl. oz.] of liquid. Strain this, and, when it is cold, mix it with the Alcohol in which the Oil of Coriander had previously been dissolved. Set it aside until the precipitate has subsided, then pour off the clear liquid, filter the remainder, and pass enough Water through the filter to obtain 550 C.c. [old form 17½ fl. oz.]. In the filtrate dissolve the Sugar by agitation, without heat, strain, and add enough Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS TOLUTANUS. *U. S.* Syrup of Tolu.

	Metric.	Old form.
Balsam of Tolu	10 Gm.	146 grains.
Precipitated Calcium Phosphate	50 Gm.	1 oz. av. 300 gr.
Sugar	850 Gm.	28 oz. av. 164 gr.
Alcohol	50 C.c.	1 fl. oz. 5 fl. dr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Balsam of Tolu in the Alcohol, in a small flask or bottle, with the aid of a gentle heat. Mix the Precipitated Calcium Phosphate with 150 Gm. [old form 5 oz. av.] of the Sugar, in a mortar, thoroughly incorporate with it the solution of the Balsam, and set

the mortar aside, in a moderately warm place, until the Alcohol has evaporated. Then triturate the residue well with 500 C.c. [old form 1 pint] of Water, gradually added, and filter the mixture through a wetted filter, returning the first portions of the filtrate until it runs through clear. To the filtrate, heated to a temperature of about 60° C. (140° F.), add the remainder of the Sugar, and dissolve it by agitation. Then allow the Syrup to cool, strain it, and pass enough Water through the filter and strainer to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Syrup of Tolu may also be made in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

SYRUPUS ZINGIBERIS. *U. S.* Syrup of Ginger.

	Metric.	Old form.
Fluid Extract of Ginger	30 C.c.	460 minims.
Precipitated Calcium Phosphate	15 Gm.	220 grains.
Sugar	850 Gm.	28 oz. av. 164 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Triturate the Fluid Extract of Ginger with the Precipitated Calcium Phosphate, and expose the mixture in a warm place until the Alcohol has evaporated. Then triturate the residue with 450 C.c. [old form 14½ fl. oz.] of Water, and filter. In the filtrate dissolve the Sugar by agitation, without heat, strain, and pass enough Water through the filter to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

Syrup of Ginger may also be prepared in the following manner:

Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the Sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by Water, until the product measures 1000 C.c. [old form 2 pints]. Mix thoroughly.

Mellita. *Honeys.*

Official honeys are thick liquid preparations closely allied to the syrups, differing merely in the use of honey as a base, instead of syrup. Their advantages over syrups are not very apparent, particularly since of late years the difficulty of obtaining pure honey has greatly increased. *Three* honeys are official.

Official Honeys.

Name.	Proportions and definition.	Preparation.
Mel.	Commercial Honey.	A saccharine secretion deposited in the honeycomb by *Apis mellifica*.
Mel Despumatum.	Clarified Honey.	Heat Honey, mixed with paper-pulp, over a water-bath, remove the scum and strain; then mix with five per cent. of its weight of Glycerin.
Mel Rosæ.	120 C.c. Fluid Extract of Rose, and enough Clarified Honey to make 1000 Gm.	Mix thoroughly.

MEL DESPUMATUM. *U. S.* Clarified Honey.

Honey, a convenient quantity.
Glycerin, a sufficient quantity.

Mix the Honey intimately with 2 per cent. of its weight of paper-pulp, which has been previously reduced to shreds, thoroughly washed and soaked in water, and then strongly expressed and again shredded. Then apply the heat of a water-bath, and, as long as any scum rises to the surface, carefully remove this. Finally, add enough Distilled Water to make up the loss incurred by evaporation, strain, and mix the strained liquid with 5 per cent. of its weight of glycerin.

MEL ROSÆ. *U. S.* Honey of Rose.

	Metric.	Old form.
Fluid Extract of Rose	120 C.c.	5 fl. oz.
Clarified Honey, a sufficient quantity,		
To make	1000 Gm.	2 pints.

Into a tared vessel introduce the Fluid Extract of Rose, then add enough Clarified Honey to make the contents weigh 1000 Gm. [or to measure, old form, 2 pints], and mix them thoroughly.

Mucilagines. *Mucilages.*

The official mucilages are thick, viscid, adhesive liquids, produced by dissolving gum in water, or by extracting with water the mucilaginous principles from vegetable substances. There are *four* official mucilages. *Two* are made without the application of heat, and *two* with heat. The mucilages are all prone to decomposition, and should never be made in larger quantities than can be used at once.

Official Mucilages.

Name.	Proportions.		Process.
Mucilago Acaciæ.	840 Gm. Acacia; Water sufficient to make 1000 Gm.	Without heat.	Wash the Acacia with cold water; then add to it 660 Gm. of Water; agitate until dissolved, and strain.
Mucilago Sassafras Medullæ.	2 Gm. Sassafras Pith; Water to make 100 C.c.		Macerate for 8 hours, and strain.
Mucilago Tragacanthæ.	6 Gm. Tragacanth; 18 Gm. Glycerin; Water sufficient to make 100 Gm.	With heat.	Mix the Glycerin with 75 C.c. Water, heat to boiling, add the Tragacanth, macerate for 24 hours with stirring. Then add enough Water to make the mixture weigh 100 Gm.; strain forcibly through muslin.
Mucilago Ulmi.	6 Gm. Elm; Water 100 C.c.		Digest the Elm with the Water, on a water-bath, in a covered vessel, during one hour, then strain.

MUCILAGO ACACIÆ. *U. S.* Mucilage of Acacia.

	Metric.	Old form.
Acacia, in small fragments	340 Gm.	18 oz. av.
Water, a sufficient quantity,		
To make	1000 Gm.	2 pints.

Wash the Acacia with cold Water, and let it drain. Then add to it enough Water to make the mixture weigh 1000 Gm. [or measure, old form, 2 pints], agitate or stir occasionally until the Acacia is dissolved, and strain. Keep the product in well-stoppered, completely filled bottles, in a cool place.

MUCILAGO SASSAFRAS MEDULLÆ. *U. S.* Mucilage of Sassafras Pith.

	Metric.	Old form.
Sassafras Pith	2 Gm.	30 grains.
Water	100 C.c.	8 fl. oz.

Macerate the Sassafras Pith in the Water during three hours, and strain.

This preparation should be freshly made, when wanted.

MUCILAGO TRAGACANTHÆ. *U. S.* Mucilage of Tragacanth.

	Metric.	Old form.
Tragacanth	6 Gm.	90 grains.
Glycerin	18 Gm.	½ fl. oz.
Water, a sufficient quantity,		
To make	100 Gm.	about 4 fl. oz.

Mix the Glycerin with 75 C.c. [old form 2½ fl. oz.] of Water in a tared vessel, heat the mixture to boiling, add the Tragacanth, and let it

macerate during twenty-four hours, stirring occasionally. Then add enough Water to make the mixture weigh 100 Gm. [or measure, old form, about 4 fl. oz.], beat it so as to make it of uniform consistence, and strain it forcibly through muslin.

MUCILAGO ULMI. *U. S.* **Mucilage of Elm.**

	Metric.	Old form.
Elm, bruised	6 Gm.	87 grains.
Water	100 C.c.	3 fl. oz.

Digest the Elm with the water, on a water-bath, in a covered vessel, during one hour, then strain.

This preparation should be freshly made, when wanted.

Emulsa. *Emulsions.*

The U. S. Pharmacopœia of 1890 introduced emulsions as a separate class of preparations: formerly they were included under the general heading of Misturæ. The necessity for differentiation in nomenclature, as preparations of established merit multiply, is apparent. Emulsions are aqueous liquids in which oleaginous substances are suspended by the intervention of gum, yolk of egg, or other viscid matter. Their method of preparation is fully considered under Part VI., Extemporaneous Liquids. There are *four* official emulsions.

Table of Official Emulsions.

Name.	Proportions.	Description.
Emulsum Ammoniaci.	40 Gm. Ammoniac with 1000 C.c. Water.	Simple gum-resin emulsions.
Emulsum Asafœtidæ.	40 Gm. Asafetida with 1000 C.c. Water.	
Emulsum Amygdalæ.	60 Gm. Sweet Almond; 10 Gm. Acacia; 30 Gm. Sugar; Water sufficient to make 1000 C.c.	Simple seed emulsion.
Emulsum Chloroformi.	40 C.c. Chloroform; 60 C.c. Expressed Oil of Almond; 15 Gm. Tragacanth; Water to make 1000 C.c.	Tragacanth emulsion.

EMULSUM AMMONIACI. *U. S.* **Emulsion of Ammoniac.**

[MISTURA AMMONIACI, PHARM. 1880.]

	Metric.	Old form.
Ammoniac	40 Gm.	146 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	8 fl. oz.

Rub the Ammoniac, in a warmed mortar, with 900 C.c. [old form 7 fl. oz.] of Water, at first very gradually added, until a uniform emulsion results. Then strain the mixture into a graduated vessel, and wash the mortar and strainer with enough Water to make the product measure 1000 C.c. [old form 8 fl. oz.].

EMULSUM AMYGDALÆ. *U. S.* **Emulsion of Almond.**

[MISTURA AMYGDALÆ, PHARM. 1880. MILK OF ALMOND.]

	Metric.	Old form.
Sweet Almond	60 Gm.	219 gr.
Acacia, in fine powder	10 Gm.	87 gr.
Sugar	30 Gm.	109 gr.
Water, a sufficient quantity,		
To make	1000 C.c.	8 fl. oz.

Having blanched the Almond, add the Acacia and Sugar, and beat them, in a mortar, until they are thoroughly mixed. Then rub the mass with 900 C.c. [old form 7 fl. oz.] of Water, at first very gradually added, until a uniform mixture results. Strain this into a graduated vessel, and wash the mortar and strainer with enough Water to make the product measure 1000 C.c. [old form 8 fl. oz.]. Mix the whole thoroughly.

EMULSUM ASAFŒTIDÆ. *U. S.* **Emulsion of Asafetida.**

[MISTURA ASAFŒTIDÆ, PHARM. 1880. MILK OF ASAFETIDA.]

	Metric.	Old form.
Asafetida, in selected tears	40 Gm.	146 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	8 fl. oz.

Rub the Asafetida, in a warmed mortar, with 900 C.c. [old form 7 fl. oz.] of Water, at first very gradually added, until a uniform emulsion results. Then strain the mixture into a graduated vessel, and wash the mortar and strainer with enough Water to make the product measure 1000 C.c. [old form 8 fl. oz.]. Mix the whole thoroughly.

EMULSUM CHLOROFORMI. *U. S.* **Emulsion of Chloroform.**

[MISTURA CHLOROFORMI, PHARM. 1880.]

	Metric.	Old form.
Chloroform	40 C.c.	158 minims.
Expressed Oil of Almond	60 C.c.	230 minims.
Tragacanth, in very fine powder	15 Gm.	55 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	8 fl. oz.

Introduce the Tragacanth into a perfectly dry bottle of sufficient capacity, add the Chloroform, and shake the bottle thoroughly, so that every part of the surface may become wetted. Then add about 250 C.c. [old form 2 fl. oz.] of Water, and incorporate it by vigorous shaking. Next add the Expressed Oil of Almond, in several portions, shaking after each addition, and when the Oil has been thoroughly emulsified, add enough Water, in divided portions, shaking after each addition, until the product measures 1000 C.c. [old form 8 fl. oz.].

Misturæ. *Mixtures.*

Mixtures, in a properly restricted sense, are aqueous liquid preparations intended for internal use, which contain suspended insoluble sub-

stances. The main object in introducing this class into the Pharmacopœia was to secure uniformity in the formulas of certain well-known and largely-used preparations. They are not permanent, as a rule, and it is not wise to keep them on hand any considerable length of time. They belong properly under the head of Extemporaneous Preparations. (See Mixtures, Part VI.) There are *four* official mixtures.

Table of Official Mixtures.

Name.	Proportions.	Description.
Mistura Cretæ.	200 Gm. Compound Chalk Powder; 400 C.c. Cinnamon Water; Water, to make 1000 C.c.	Mixtures containing insoluble powder in suspension.
Mistura Ferri Composita.	6 Gm. Ferrous Sulphate; 8 Gm. Potassium Carbonate; 18 Gm. Myrrh; 18 Gm. Sugar; 60 C.c. Spirit of Lavender; Rose Water, to make 1000 C.c.	
Mistura Glycyrrhizæ Composita.	30 Gm. Pure Extract of Glycyrrhiza; 50 C.c. Syrup; 100 C.c. Mucilage of Acacia; 120 C.c. Camphorated Tincture of Opium; 60 C.c. Wine of Antimony; 30 C.c. Spirit of Nitrous Ether; Water, to make 1000 C.c.	
Mistura Rhei et Sodæ.	35 Gm. Sodium Bicarbonate; 15 C.c. Fluid Extract of Rhubarb; 3 C.c. Fluid Extract of Ipecac; 350 C.c. Glycerin; 35 C.c. Spirit of Peppermint; Water, to make 1000 C.c.	Mixture not containing insoluble powders in suspension.

MISTURA CRETÆ. *U. S.* Chalk Mixture.

	Metric.	Old form.
Compound Chalk Powder	200 Gm.	365 grains.
Cinnamon Water	400 C.c.	1½ fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	4 fl. oz.

Rub the Compound Chalk Powder, in a mortar, with the Cinnamon Water and about 200 C.c. [old form 6 fl. dr.] of Water gradually added, to a uniform mixture; transfer this to a graduated vessel, and rinse the mortar with enough Water to make the product measure 1000 C.c. [old form 4 fl. oz.]. Mix the whole thoroughly.

This preparation should be freshly made, when wanted.

MISTURA FERRI COMPOSITA. *U. S.* Compound Iron Mixture.

[Griffith's Mixture.]

	Metric.	Old form.
Ferrous Sulphate, in clear crystals	6 Gm.	11 grains.
Myrrh, in small pieces	18 Gm.	33 grains.
Sugar	18 Gm.	33 grains.
Potassium Carbonate	8 Gm.	15 grains.
Spirit of Lavender	60 C.c.	2 fl. dr.
Rose Water, a sufficient quantity,		
To make	1000 C.c.	4 fl. oz.

Rub the Myrrh, Sugar, and Potassium Carbonate, in a mortar with 700 C.c. [old form 2½ fl. oz.] of Rose Water, at first very gradually added, so that a uniform mixture may result. Transfer this to a graduated vessel, add the Spirit of Lavender, then the Ferrous Sulphate, previously dissolved in about 50 C.c. [old form 1½ fl. dr.] of Rose Water, and, lastly, enough Rose Water to make the product measure 1000 C.c. [old form 4 fl. oz.]. Mix the whole thoroughly.

This preparation should be freshly made, when wanted.

MISTURA GLYCYRRHIZÆ COMPOSITA. *U. S.* **Compound Mixture of Glycyrrhiza.**

[BROWN MIXTURE.]

	Metric.	Old form.
Pure Extract of Glycyrrhiza	30 Gm.	488 grains.
Syrup	50 C.c.	1½ fl. oz.
Mucilage of Acacia	100 C.c.	8 fl. oz.
Camphorated Tincture of Opium	120 C.c.	8 fl. oz 7. fl. dr.
Wine of Antimony	60 C.c.	2 fl. oz.
Spirit of Nitrous Ether	30 C.c.	1 fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Rub the Pure Extract of Glycyrrhiza, in a mortar, with 500 C.c. [old form 16 fl. oz.] of Water, until it is dissolved. Transfer the solution to a graduated vessel containing the other ingredients, and rinse the mortar with enough Water to make the product measure 1000 C.c. [old form 2 pints]. Mix the whole thoroughly.

MISTURA RHEI ET SODÆ. *U. S.* **Mixture of Rhubarb and Soda.**

	Metric.	Old form.
Sodium Bicarbonate	35 Gm.	511 grains.
Fluid Extract of Rhubarb	15 C.c.	4 fl. dr.
Fluid Extract of Ipecac	3 C.c.	46 minims.
Glycerin	350 C.c.	11 fl. oz.
Spirit of Peppermint	35 C.c.	1 fl. oz. 1 fl. dr.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Sodium Bicarbonate in about 400 C.c. [old form 13 fl. oz.] of Water. Then add the Fluid Extracts, the Glycerin, and the Spirit of Peppermint, and, lastly, enough Water, to make 1000 C.c. [old form 2 pints].

Glycerita. *Glycerites.*

Glycerites are mixtures of medicinal substances with glycerin. Glycerin is a valuable solvent; and one of the principal advantages of the glycerites is that they afford a rapid and simple method of making aqueous solutions of substances which are not otherwise easily soluble. The solutions of carbolic acid, gallic acid, tannic acid, and tar, etc., in glycerin are permanent preparations, and they could be made very concentrated if necessary: the ease with which they can be diluted with

water or alcohol, without precipitation, renders such glycerites especially useful at the prescription counter. *Two* old glycerites and *two* new ones were made official in the U. S. P. 1890. The old glycerites of carbolic acid and tannic acid were inadvertently omitted from the U. S. P. 1880. The new glycerites of boroglycerin and hydrastis are largely used, and they merit a place in the Pharmacopœia.

Official Glycerites.

Name.	Proportion.
Glyceritum Acidi Carbolici.	Carbolic Acid, 20 Gm.; Glycerin, 80 Gm.
Glyceritum Acidi Tannici.	Tannic Acid, 20 Gm.; Glycerin, 80 Gm.
Glyceritum Amyli.	Starch, 10 Gm.; Glycerin, 80 Gm.; Water, 10 C.c. (A translucent jelly.)
Glyceritum Boroglycerini.	Boric Acid, 31 Gm.; Glycerin, 69 Gm.
Glyceritum Hydrastis.	Hydrastis, 1000 Gm.; Glycerin, 500 C c.; Alcohol and Water, to make 1000 C c.
Glyceritum Vitelli.	45 Gm. Fresh Yolk of Egg; 55 Gm. Glycerin.

GLYCERITUM ACIDI CARBOLICI. *U. S.* Glycerite of Carbolic Acid.

	Metric.	Old form.
Carbolic Acid	20 Gm.	4 oz. av.
Glycerin	80 Gm.	16 oz. av.
To make	100 Gm.	20 oz. av.

Weigh the Carbolic Acid and Glycerin, successively, into a tared capsule, and stir them together until the Acid is dissolved. Then transfer the solution to a bottle. (This glycerite may be made by measure by dissolving 4 oz. av. of Carbolic Acid in enough Glycerin to make one pint.)

GLYCERITUM ACIDI TANNICI. *U. S.* Glycerite of Tannic Acid.

	Metric.	Old form.
Tannic Acid	20 Gm.	4 oz. av.
Glycerin	80 Gm.	16 oz. av.
To make	100 Gm.	20 oz. av.

Weigh the Tannic Acid and Glycerin, successively, into a tared porcelain capsule, avoiding contact with metallic utensils, and apply the heat of a water-bath, until the Acid is completely dissolved. Then transfer the solution to a bottle. (This glycerite may be made by measure by dissolving 4 oz. of Tannic Acid in enough Glycerin to make one pint. Heat facilitates the solution.)

GLYCERITUM AMYLI. *U. S.* Glycerite of Starch.

	Metric.	Old form.
Starch	10 Gm.	290 grains.
Water	10 C.c.	5 fl. dr.
Glycerin	80 Gm.	4 fl. oz.

To the Starch, contained in a porcelain capsule, add the Water and Glycerin, and stir until a homogeneous mixture is produced. Then

apply a heat gradually raised to 140° C. (284° F.), and not exceeding 144° C. (291° F.), stirring constantly, until a translucent jelly is formed. Transfer the product to suitable vessels, provided with well-fitting covers.

GLYCERITUM BOROGLYCERINI. *U. S.* Glycerite of Boroglycerin.

[GLYCERITE OF GLYCERYL BORATE. SOLUTION OF BOROGLYCERIDE.]

	Metric.	Old form.
Boric Acid, in fine powder	310 Gm.	5 oz. av.
Glycerin, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Heat 460 Gm. [old form 7 oz. av. 158 gr.] of Glycerin, in a tared porcelain capsule, to a temperature not exceeding 150° C. (302° F.), and add the Boric Acid in portions, constantly stirring. When all is added and dissolved, continue the heat at the same temperature, frequently stirring, and breaking up the film which forms on the surface. When the mixture has been reduced to the weight of 500 Gm. [old form 8 oz. av.], add to it 500 Gm. [old form 8 oz. av.] of Glycerin, mix thoroughly, and transfer it to suitable vessels.

GLYCERITUM HYDRASTIS. *U. S.* Glycerite of Hydrastis.

	Metric.	Old form.
Hydrastis, in No. 60 powder	1000 Gm.	25 oz. av.
Glycerin	500 C.c.	12 fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	24 fl. oz.

Moisten the Hydrastis with 350 C.c. [old form 8½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol until the Hydrastis is practically exhausted. To the percolate add 250 C.c. [old form 6 fl. oz.] of Water, and then drive off the Alcohol by evaporation or distillation. After the Alcohol is driven off, add enough Water to the residue to make it measure 500 C.c. [old form 12 fl. oz.], and set it aside for twenty-four hours. Then filter, pass enough Water through the filter to make the filtrate measure 500 C.c. [old form 12 fl. oz.], add the Glycerin, and mix thoroughly.

GLYCERITUM VITELLI. *U. S.* Glycerite of Yolk of Egg.

[GLYCONIN.]

	Metric.	Old form.
Fresh Yolk of Egg	45 Gm.	140 grains.
Glycerin	55 Gm.	170 grains.
To make	100 Gm.	310 grains.

Rub the Yolk of Egg, in a mortar, with the Glycerin, gradually added, until they are thoroughly mixed. Then transfer the mixture to a bottle.

QUESTIONS ON CHAPTER XXII.

AQUEOUS SOLUTIONS CONTAINING SWEET OR VISCID SUBSTANCES.

What are syrups?
What kinds of sugar should be used in making syrups?
How many methods of making syrups are recognized by the U. S. P.?
Describe the details for making syrups by heat. For making syrups without heat.
What objection is there to making syrups by the addition of fluid extracts, tinctures, etc., to syrup?
What official syrup is made by digestion?
Is this method a satisfactory one?
What method would be preferable?
What official syrup is made by maceration?
How is it made?
How is the process of percolation in making syrups conducted?
What precautions are necessary to percolate a syrup successfully?
How may syrups be preserved?
Is the addition of alcohol or chemicals objectionable? Why?
What is the best disposition to make of fermented syrups?
How may fruit juices be effectually preserved?
How many official syrups are there?
Name the official syrups made by solution with heat.
Which of these are made by solution involving chemical action?
How many are made by the simple addition of medicating liquid to syrup? Name them.
Which of these are made with mucilage?
Which with flavored acidulated solution?
Which with aromatic tincture?
Which with fluid extract?
Name the official syrups, made by the agitation of sugar with medicating liquid without heat.
Which of these contain acetic acid?
How many are made from cold aqueous infusion? Name them.
Which one is made by infusion? Which one is made by digestion?
Which from emulsion? Which from juice?
Which three from medicated water from tincture?
Which from medicated water from fluid extract?
How many are made from simple admixture or solution? Name them.
Which two are made from solution involving chemical reaction?
How many are made by maceration or digestion? Name them.
Give the formula and mode of preparing Syrupus.
What is its specific gravity?
How is syrup of acacia made?
Does this syrup keep well?
Give the formula and mode of making syrup of citric acid.
What is the formula in symbols of hydriodic acid?
What is its molecular weight?
How is syrup of hydriodic acid made?
How much hydriodic acid does it contain?
What is the specific gravity of the syrup?
How may the presence of free iodine in the syrup be detected? Of sulphuric acid? Of hydrochloric acid?
What is the strength of syrup of garlic, and how is it made?
Give the process for making syrup of althæa. Syrup of almond. Syrup of orange.
What are the ingredients used in making the syrup of lactophosphate of calcium?
Give an outline of the process for making it.
Write out in full the Latin name.
How is syrup of lime prepared?
What is the formula in symbols of ferrous iodide?
What is its molecular weight?

How is the syrup of ferrous iodide prepared?
How much ferrous iodide does it contain?
Describe the appearance and physical characters of this syrup.
What colored precipitate does it yield with test-solution of potassium ferricyanide?
Of what does this indicate the presence?
How may the presence of free iodine be detected?
Write out in full the Latin name of the "syrup of the phosphates of iron, quinine, and strychnine."
What are the ingredients used in making this syrup?
Give an outline of the process for making it.
Of what hypophosphites does the syrup of hypophosphites consist?
How is the syrup prepared?
What preparation of iron is contained in the syrup of hypophosphites with iron?
How is this syrup prepared?
Write out its name in full.
How is syrup of ipecac made?
How much ipecac is there in two and a half troy ounces?
About how much in a fluidounce?
Write out the Latin name in full.
Give the formula for syrup of krameria. For syrup of lactucarium.
Write out in full the Latin name of syrup of tar.
How much tar is used to make one hundred parts of the syrup?
How is the syrup made?
Write out in full the Latin name of syrup of wild cherry.
How much wild cherry is used to make one hundred parts?
What degree of fineness is directed for the powder?
How is the syrup made?
How much glycerin does it contain?
Give the formula for syrup of rhubarb.
How is the syrup made?
Give the formula and mode of preparing the aromatic syrup of rhubarb.
Give the formula for syrup of rose. For syrup of rubus.
How is the syrup of raspberry prepared?
What are the ingredients of compound syrup of sarsaparilla?
How is the syrup prepared?
Give the formula and mode of preparing syrup of squill.
What are the ingredients of compound syrup of squill?
How is this syrup prepared?
How much antimony and potassium tartrate is there in a troy ounce?
Give the formula and mode of making syrup of senega.
What aromatic is used in making syrup of senna?
How is the syrup of senna made?
How much senna is there in one hundred parts of syrup?
Give the formula and mode of making syrup of tolu.
How is syrup of ginger made?
What is the strength of it?
What are official emulsions, and how many are there? Name them.
What were these preparations called in the previous U. S. P.?
Give the formula and mode of making emulsion of ammoniac. Emulsion or almond. Emulsion of asafetida. Chloroform.
What is the popular name or synonyme of emulsion of asafetida?
What are official honeys? How many are there? Name them.
Give the Latin name and mode of preparing commercial honey. Clarified honey. Honey of rose.
What are official mucilages, and how many are there?
How many mucilages are prepared without heat? Name them.
How is mucilage of acacia prepared?
Give the Latin name, formula, and mode of making mucilage of sassafras pith. Mucilage of tragacanth. Mucilage of elm.
What are official mixtures, and how many are there?
Give the Latin name, formula, and mode of making chalk mixture.
Should chalk mixture be kept on hand?
What is the Latin name of compound iron mixture?
What is the popular name or synonyme of compound iron mixture?
Why is myrrh in small pieces preferable to the powder?

Give the formula and mode of preparing it.
In what form does the iron exist in the finished mixture?
Should the mixture be freshly made?
What change takes place on keeping?
How many contain insoluble powder in suspension? Name them.
How many do not contain insoluble powder in suspension? Name them.
Give the Latin name, formula, and mode of preparing mixture of rhubarb and soda.
What are glycerites, and how many are official? Name them.
Give the formula and mode of making glycerite of starch. Glycerite of carbolic acid. Glycerite of tannic acid. Glycerite of boroglycerin. Glycerite of hydrastis. Glycerite of yolk of egg.
Write out in full the Latin name of this preparation.
What is the popular name or synonyme?

CHAPTER XXIII.

ALCOHOLIC SOLUTIONS.

Spiritus. *Spirits.*

Spirits from a pharmaceutical point of view are simply *alcoholic* solutions of volatile substances. Like the medicated waters, the active ingredient may be solid, liquid, or gaseous. None are made by percolation, but they are officially prepared in five ways: 1. By simple solution. 2. By solution with maceration. 3. By gaseous solution. 4. By chemical reaction. 5. By distillation. The number of official spirits is *twenty-five.*

1. **By Simple Solution.**—This is the most usual method of making spirits: of the official preparations of this class *eighteen,* or three-fourths of the whole number, are prepared in this way, whilst *ten* of these eighteen are merely solutions of volatile oils in alcohol of different strengths, without any other addition. No skill is required to make these, but a great deal of conscientious care must be used in the selection of the volatile oil, that it be of the best quality and recently distilled. Filtration is usually unnecessary.

Spiritus. *U. S. P.*

Spirits made by Simple Solution.

Name.	Proportion.	Uses and Dose.
Spiritus Ætheris.	825 C.c. Ether; 675 C.c. Alcohol.	Stimulant, f℥i to f℥iij.
Spiritus Ætheris Compositus.	825 C.c. Ether; 650 C.c. Alcohol; 25 C.c. Ethereal Oil.	Anodyne, stimulant, 30 to 60♏.
Spiritus Ammoniæ Aromaticus.	34 Gm. Ammonium Carbonate; 90 C.c. Ammonia Water; 10 C.c. Oil of Lemon; 1 C.c. Oil of Lavender Flowers; 1 C.c. Oil of Nutmeg; 700 C.c. Alcohol; Distilled Water, to make 1000 C.c.	Antacid, 30 to 60♏.
Spiritus Amygdalæ Amaræ.	10 C.c. Oil of Bitter Almond; 800 C.c. Alcohol; Distilled Water, to make 1000 C.c.	Flavor, 1 to 2♏.
Spiritus Anisi.	100 C.c. Oil of Anise; 900 C.c. Deodorized Alcohol.	Carminative, f℥i.
Spiritus Aurantii.	50 C.c. Oil of Orange Peel; 950 C.c. Deodorized Alcohol.	Flavor.
Spiritus Aurantii Compositus.	200 C.c. Oil of Orange Peel; 50 C.c. Oil of Lemon; 20 C.c. Oil of Coriander; 5 C.c. Oil of Anise; Deodorized Alcohol, sufficient to make 1000 C.c.	Flavor.

Spirits made by Simple Solution.—(*Continued.*)

Name.	Proportion.	Uses and Dose.
Spiritus Camphoræ.	100 Gm. Camphor; Alcohol, sufficient to make 1000 C.c.	Stimulant, 5 to 60♏.
Spiritus Chloroformi.	60 C.c. Chloroform; 940 C.c. Alcohol.	Sedative, stimulant, 10 to 60♏.
Spiritus Cinnamomi.	100 C.c. Oil of Cinnamon; 900 C.c. Alcohol.	Stimulant, 5 to 15♏.
Spiritus Gaultheriæ.	50 C.c. Oil of Gaultheria; 950 C.c. Alcohol.	Flavor, 5 to 15♏.
Spiritus Glonoini.	1 Gm. Nitroglycerin to 99 Gm. Alcohol.	Cardiac stimulant, 1 to 2♏.
Spiritus Juniperi.	50 C.c. Oil of Juniper; 950 C.c. Alcohol.	Stimulant, diuretic, f℥i to f℥ij.
Spiritus Juniperi Compositus.	8 C.c. Oil of Juniper; 1 C.c. Oil of Caraway; 1 C.c. Oil of Fennel; 1400 C.c. Alcohol; Water, sufficient to make 2000 C.c.	Stimulant, diuretic, f℥ij to f℥iv.
Spiritus Lavandulæ.	50 C.c. Oil of Lavender Flowers; 950 C.c. Deodorized Alcohol.	Flavor, f℥ss to f℥i.
Spiritus Myrciæ.	16 C.c. Oil of Myrcia; 1 C.c. Oil of Orange Peel; 1 C.c. Oil of Pimenta; 1220 C.c. Alcohol; Water, sufficient to make 2000 C.c.	Externally.
Spiritus Myristicæ.	50 C.c. Oil of Nutmeg; 950 C.c. Alcohol.	Flavor, f℥ss to f℥i.
Spiritus Phosphori.	1.2 Gm. Phosphorus; Absolute Alcohol, sufficient to make 1000 C.c.	To make Elixir of Phosphorus.

2. **Solution with Maceration.**—This method is employed solely in the Pharmacopœia when it is desirable to introduce the coloring-matter of the drug into the preparation. This has been done in order to bestow individuality, and in deference to popular feeling in favor of high colors. It is very doubtful whether either object is worthy of consideration.

Spirits made by Solution with Maceration.

Name.	Preparation.	Uses and Dose.
Spiritus Limonis.	50 C.c. Oil of Lemon; 50 Gm. Lemon Peel, fresh; Deodorized Alcohol, to make 1000 C.c.	For flavoring.
Spiritus Menthæ Piperitæ.	100 C.c. Oil of Peppermint; 10 Gm. Peppermint, bruised; Alcohol, to make 1000 C.c.	Carminative, 10 to 20♏.
Spiritus Menthæ Viridis.	100 C.c. Oil of Spearmint; 10 Gm. Spearmint, bruised; Alcohol, to make 1000 C.c.	Carminative, 10 to 20♏.

3. **By Gaseous Solution.**—The only official representative of this class is the spirit of ammonia, and it is the only preparation in the Pharmacopœia that is made by converting a gaseous aqueous solution into a gaseous alcoholic solution by expelling the dissolved gas from water by heat and causing it to be redissolved in alcohol. The spirit

is assayed by volumetric solution of sulphuric acid, and brought to the standard strength of 10 per cent. of gaseous ammonia.

Spirit made by Gaseous Solution.

Name.	Preparation.	Use and Dose.
Spiritus Ammoniæ.	Stronger Water of Ammonia; Heat; Alcohol; 10 p.c. Gas; assay.	Stimulant, 5 to 30♏.

4. **By Chemical Reaction.**—There is but *one* spirit in the Pharmacopœia made by chemical reaction, and that is spirit of nitrous ether. As explained elsewhere (Part IV.), it is the product of the action of nitric acid upon alcohol, and is an alcoholic solution of ethyl nitrite.

Spirit made by Chemical Reaction.

Name.	Preparation.	Use and Dose.
Spiritus Ætheris Nitrosi.	About 4 p.c. Ethyl Nitrite.	Diaphoretic, diuretic, f℥ss to f℥i.

5. **By Distillation.**—This method of making spirits is the oldest and in many respects the best in use. When the desirable volatile principles which are present in the preparation when finished can be vaporized at the temperature of boiling alcohol or diluted alcohol, distillation is preferred. In the case of liquids containing some oils of high boiling-points, it is necessary to obtain the oils by distillation with water and afterwards mix the distillate with alcohol. It is certain, however, that spirits made by the admixture of volatile oils with alcohol, as in Class 1, are often deficient in the more delicate and volatile principles found in the substances from which they are distilled. These principles are often soluble in water and insoluble in the oil, and necessarily in the distillation of the volatile oil with water they must be found in the water, and are absent from the oil. This is well illustrated in the case of oil of neroli and orange flower water: the latter has much the more fragrant odor when compared with the oil obtained in the same distillation from the same flowers and subjected to the same temperature. The only official spirits made by distillation are *two* in number, —whiskey and brandy.

Spirits made by Distillation.

Name.	Preparation.	Use and Dose.
Spiritus Frumenti.	By distillation from fermented grain; must be at least 2 years old.	Stimulant, f℥ss to f℥i.
Spiritus Vini Gallici.	By distillation from fermented grapes; must be at least 4 years old.	Stimulant, f℥ss to f℥i.

PRACTICAL PROCESSES FOR OFFICIAL SPIRITS.

SPIRITUS ÆTHERIS. *U. S.* Spirit of Ether.

	Metric.	Old form.
Ether	325 C.c.	4 fl. oz.
Alcohol	675 C.c.	8¼ fl. oz.
To make	1000 C.c.	12¼ fl. oz.

Mix them.

SPIRITUS ÆTHERIS COMPOSITUS. *U. S.* Compound Spirit of Ether.

[HOFFMANN'S ANODYNE.]

	Metric.	Old form.
Ether	325 C.c.	8 fl. oz.
Alcohol	650 C.c.	16 fl. oz.
Ethereal Oil	25 C.c.	5 fl dr.
To make	1000 C.c.	24¼ fl. oz

Mix them.

SPIRITUS ÆTHERIS NITROSI. *U. S.* Spirit of Nitrous Ether.

An alcoholic solution of Ethyl Nitrite [$C_2H_5NO_2 = 74.87$], yielding, when freshly prepared, and tested in a nitrometer, not less than 11 times its own volume of Nitrogen Dioxide [$NO = 29.97$].

	Metric.	Old form.
Sodium Nitrite	770 Gm.	5 oz. av. 190 gr.
Sulphuric Acid	520 Gm.	8 oz. av. 292 gr.
Sodium Carbonate	10 Gm.	81 grains.
Potassium Carbonate, completely deprived of water by drying	30 Gm.	98 grains.
Deodorized Alcohol,		
Water, each, a sufficient quantity.		

Dissolve the Sodium Nitrite in 1000 C.c. [old form 6 fl. oz. 6 fl. dr.] of Water, and put the solution into a suitable flask, connected with a condenser kept cold by ice-cold water; then add 550 C.c. [old form 3 fl. oz. 6 fl. dr.] of Deodorized Alcohol, and mix well. Through a cork fitted into the mouth of the flask insert a funnel-tube dipping below the surface of the liquid. With the condenser connect a receiver, and keep this surrounded by a mixture of common salt and crushed ice. Then gradually introduce into the flask, through the funnel-tube, the Sulphuric Acid previously diluted with 1000 C.c. [old form 6 fl. oz. 6 fl. dr.] of Water. Distillation will usually commence before the whole of the Acid has been added. When all the Acid has been introduced, regulate the distillation by the application or withdrawal of a gentle heat until no more nitrous ether distils over. Wash the distillate, first, with 100 C.c. [old form 5½ fl. dr.] of ice-cold Water to remove any Alcohol which may have passed over, and then remove any traces of Acid by washing the Ether with 100 C.c. [old form 5½ fl. dr.] of ice-cold Water, in which the Sodium Carbonate had previously been dissolved. Carefully separate the Ether from the aqueous liquid, and agitate it, in a well-stoppered vial, with the Potassium Carbonate to remove traces of water. Then filter it through a pellet of cotton, in a covered funnel, into a tared bottle containing

2000 C.c. [old form 13½ fl. oz.] of Deodorized Alcohol. Ascertain the weight of the Nitrous Ether filtered into the Alcohol by noting the increase of weight of the tared bottle and contents, and then add enough Deodorized Alcohol to make the mixture weigh 22 times the weight of the Nitrous Ether added. Lastly, transfer the product to small, dark, amber-colored, well-stoppered vials, and keep them in a cool place, remote from lights or fire.

A clear, mobile, volatile, and inflammable liquid of a pale yellowish or faintly greenish-yellow tint, having a fragrant, ethereal, and pungent odor free from acridity, and a sharp, burning taste.

Specific gravity: about 0.836 to 0.842 at 15° C. (59° F.).

When freshly prepared, or even after being kept for some time with but little exposure to light and air, it is neutral to litmus paper. When long kept, or after having been freely exposed to air and light, it acquires an acid reaction, but it should not effervesce when a crystal of potassium bicarbonate is dropped into it.

If a test-tube be half filled with the Spirit, and put into a water-bath heated to 65° C. (149° F.) until it has acquired this temperature, the Spirit should boil distinctly upon the addition of a few small pieces of broken glass.

If 10 C.c. of the Spirit be mixed with 5 C.c. of Potassium Hydrate T S., previously diluted with 5 C.c. of Water, the mixture will assume a yellow color which should not turn decidedly brown within twelve hours (limit of *aldehyde*).

If 5 C.c. of recently prepared Spirit of Nitrous Ether be introduced into a nitrometer, and followed, first, by 10 C.c. of Potassium Iodide T.S., and then by 10 C.c. of normal Sulphuric Acid, the volume of nitrogen dioxide generated at the ordinary indoor temperature (assumed to be at or near 25° C., or 77° F.) should not be less than 55 C.c. (corresponding to about 4 per cent. of pure ethyl nitrite).

For comments on the process, see Spiritus Ætheris Nitrosi, Part V.

SPIRITUS AMMONIÆ. *U. S.* Spirit of Ammonia.

An alcoholic solution of Ammonia [$NH_3 = 17.01$] containing 10 per cent., by weight, of the gas.

	Metric.	Old form.
Stronger Ammonia Water	250 C c.	8 fl. oz.
Alcohol, recently distilled, and, after distillation, kept in glass vessels, a sufficient quantity.		

Pour the Stronger Ammonia Water into a flask provided with a safety funnel, and connected, by means of a glass condenser, with a well-cooled receiver containing 500 C.c. [old form 16 fl. oz.] of Alcohol, the delivery tube of the condenser reaching to near the bottom of the receiver. Heat the flask carefully, and very gradually, to a temperature not exceeding 60° C. (140° F.), and maintain it at that temperature for about ten minutes. Then disconnect the receiver, and, having ascertained the ammoniacal strength of the contents by means of normal sulphuric acid (rosolic acid test-solution being used as indicator), add enough Alcohol to make the product contain 10 per cent., by weight, of Ammonia.

Keep the Spirit in glass-stoppered bottles, in a cool place.

A colorless liquid, having a strong odor of ammonia, and a specific gravity of about 0.810 at 15° C. (59° F.).

When diluted with water, it should respond to the tests for identity and purity mentioned under Ammonia Water (see *Aqua Ammoniæ*).

If 3.4 Gm. (or 4.2 C.c.) of Spirit of Ammonia be diluted with water, it should require, for complete neutralization, 20 C.c. of normal sulphuric acid (each C.c. corresponding to 0.5 per cent. of Ammonia), rosolic acid being used as indicator.

For comments on the process, see Spiritus Ammoniæ, Part IV.

SPIRITUS AMMONIÆ AROMATICUS. *U. S.* **Aromatic Spirit of Ammonia.**

	Metric.	Old form
Ammonium Carbonate, in translucent pieces .	34 Gm.	500 grains.
Ammonia Water	90 C.c.	2 fl. oz. 7 fl. dr.
Oil of Lemon	10 C.c.	2½ fl. dr.
Oil of Lavender Flowers	1 C.c.'	15 minims.
Oil of Nutmeg	1 C.c.	15 minims.
Alcohol	700 C.c.	22 fl. oz. 3 fl. dr.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Ammonia Water, contained in a flask, add 140 C.c. [old form 4½ fl. oz.] of Distilled Water, and afterwards the Ammonium Carbonate reduced to a moderately fine powder. Close the flask and agitate the contents until the Carbonate is dissolved. Introduce the Alcohol into a graduated bottle of suitable capacity, add the oils, then gradually add the solution of Ammonium Carbonate, and afterwards enough Distilled Water to make the product measure 1000 C.c. [old form 2 pints]. Set the liquid aside during twenty-four hours in a cool place, occasionally agitating, then filter it through paper, in a well-covered funnel. (If the white crystalline precipitate which often falls when the water is added has not disappeared after the liquid has stood twenty-four hours, shake thoroughly and allow it to stand a day longer before filtering.)

Keep the product in glass-stoppered bottles, in a cool place.

A nearly colorless liquid when freshly prepared, but gradually acquiring a somewhat darker tint.

It has a pungent, ammoniacal odor and taste.

Specific gravity: about 0.905 at 15° C. (59° F.).

For comments on the process, see Spiritus Ammoniæ Aromaticus, Part IV.

SPIRITUS AMYGDALÆ AMARÆ. *U. S.* **Spirit of Bitter Almond.**
[ESSENCE OF BITTER ALMOND.]

	Metric.	Old form.
Oil of Bitter Almond	10 C.c.	154 minims.
Alcohol	800 C.c.	25½ fl. oz.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Oil in the Alcohol, and add enough Distilled Water to make the product measure 1000 C.c. [old form 2 pints].

SPIRITUS ANISI. *U. S.* **Spirit of Anise.**

	Metric.	Old form.
Oil of Anise	100 C.c.	1 fl. oz.
Deodorized Alcohol	900 C.c.	9 fl. oz.
To make	1000 C.c.	10 fl. oz.

Mix them.

SPIRITUS AURANTII. *U. S.* Spirit of Orange.

	Metric.	Old form.
Oil of Orange Peel	50 C.c.	6½ fl. dr.
Deodorized Alcohol	950 C.c.	15 fl. oz. 1½ fl. dr.
To make	1000 C.c.	1 pint.

Mix them.

SPIRITUS AURANTII COMPOSITUS. *U. S.* Compound Spirit of Orange.

	Metric.	Old form.
Oil of Orange Peel	200 C.c.	6 fl. oz. 3 fl. dr.
Oil of Lemon	50 C.c.	1 fl. oz. 5 fl. dr.
Oil of Coriander	20 C.c.	5 fl. dr.
Oil of Anise	5 C.c.	76 minims.
Deodorized Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix them. Keep the product in completely filled, well-stoppered bottles, in a cool and dark place.

SPIRITUS CAMPHORÆ. *U. S.* Spirit of Camphor.

	Metric.	Old form.
Camphor	100 Gm.	3 oz. av. 148 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Camphor in 800 C.c. [old form 25½ fl. oz.] of Alcohol, filter through paper, and pass enough Alcohol through the filter to make the product measure 1000 C.c. [old form 2 pints].

SPIRITUS CHLOROFORMI. *U. S.* Spirit of Chloroform.

	Metric.	Old form.
Chloroform	60 C.c.	1 fl. oz. 7½ fl. dr.
Alcohol	940 C.c.	30 fl. oz. ½ fl. dr.
To make	1000 C.c.	2 pints.

Mix them.

SPIRITUS CINNAMOMI. *U. S.* Spirit of Cinnamon.

	Metric.	Old form.
Oil of Cinnamon	100 C.c.	1 fl. oz.
Alcohol	900 C.c.	9 fl. oz.
To make	1000 C.c.	10 fl. oz.

Mix them.

SPIRITUS FRUMENTI. *U. S.* Whiskey.

An alcoholic liquid obtained by the distillation of the mash of fermented grain (usually of mixtures of corn, wheat, and rye), and at least two years old.

An amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction.

Its specific gravity should not be more than 0.930, nor less than 0.917, corresponding, approximately, to an alcoholic strength of 44 to 50 per cent. by weight, or 50 to 58 per cent. by volume.

If 100 C.c. of Whiskey be very slowly evaporated in a tared capsule on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor (absence of more than traces of *fusel oil from grain*); and the residue, when dried at 100° C. (212° F.), should not weigh more than 0.25 Gm. This residue should have no sweet or distinctly spicy taste (absence of *added sugar*, *glycerin*, or *aromatic substances*). It should almost completely dissolve in 10 C c. of cold water, forming a solution which is colored not deeper than light green by a few drops of dilute ferric chloride T. S. made by mixing the latter with 10 volumes of water (absence of more than traces of *oak tannin* from casks).

To render 100 C.c. of Whiskey distinctly alkaline to litmus should not require more than 1.2 C.c. of potassium hydrate V. S. (limit of *free acid*).

SPIRITUS GAULTHERIÆ. *U. S.* Spirit of Gaultheria.

	Metric.	Old form.
Oil of Gaultheria	50 C.c.	1 fl. oz.
Alcohol	950 C.c.	19 fl. oz.
To make	1000 C.c.	20 fl. oz.

Mix them.

SPIRITUS GLONOINI. *U. S.* Spirit of Glonoin.

[SPIRIT OF NITROGLYCERIN.]

An alcoholic solution of Glonoin [Glyceryl (or Propenyl) trinitrate, or Nitroglycerin; $C_3H_5(NO_3)_3 = 226.58$], containing 1 per cent., by weight, of the substance.

Spirit of Glonoin should be kept and transported in well-stoppered tin cans, and should be stored in a cool place, remote from lights or fire.

Great care should be exercised in handling, packing, transporting, or storing the Spirit, since a dangerous explosion may result if any considerable quantity of it be spilled and the alcohol be partly or wholly lost by evaporation.

A clear, colorless liquid, possessing the odor and taste of alcohol. Caution should be exercised in tasting it, since even a small quantity of it is liable to produce a violent headache. The same effect is produced when it is freely applied to the skin.

It is neutral to litmus paper.

Specific gravity: 0.826 to 0.832 at 15° C. (59° F.).

On diluting 10 C.c. of the Spirit with 15 C.c. of water,—both liquids, as well as the mixture, when measured, being brought to 15° C. (59° F.),—the liquid will exhibit at most a faint cloudiness, but the addition of a further portion of 5 C.c. of water should produce a white turbidity.

If the specific gravity of the Spirit be higher than 0.840, or if 10 C.c. of it be rendered turbid by less than 10 C.c. of water, the Spirit should be rejected.

SPIRITUS JUNIPERI. *U. S.* Spirit of Juniper.

	Metric.	Old form.
Oil of Juniper	50 C.c.	1 fl. oz.
Alcohol	950 C.c.	19 fl. oz.
To make	1000 C.c.	20 fl. oz.

Mix them.

SPIRITUS JUNIPERI COMPOSITUS. *U. S.* **Compound Spirit of Juniper.**

	Metric.	Old form.
Oil of Juniper	8 C.c.	80 minims.
Oil of Caraway	1 C.c.	4 minims.
Oil of Fennel	1 C.c.	4 minims.
Alcohol	1400 C.c.	11 fl. oz.
Water, a sufficient quantity,		
To make	2000 C.c.	1 pint.

Dissolve the Oils in the Alcohol, and gradually add enough Water to make the product measure 2000 C.c. [old form 1 pint].

SPIRITUS LAVANDULÆ. *U. S.* **Spirit of Lavender.**

	Metric.	Old form.
Oil of Lavender Flowers	50 C.c.	1 fl. oz.
Deodorized Alcohol	950 C.c.	19 fl. oz.
To make	1000 C.c.	20 fl. oz.

Mix them.

SPIRITUS LIMONIS. *U. S.* **Spirit of Lemon.**

[ESSENCE OF LEMON.]

	Metric.	Old form.
Oil of Lemon	50 C.c.	884 minims.
Lemon Peel, freshly grated	50 Gm.	865 grains.
Deodorized Alcohol, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Dissolve the Oil of Lemon in 900 C.c. [old form 14½ fl. oz.] of Deodorized Alcohol, add the Lemon Peel, and macerate for twenty-four hours. Then filter through paper, and add, through the filter, enough Deodorized Alcohol to make the Spirit measure 1000 C.c. [old form 1 pint].

SPIRITUS MENTHÆ PIPERITÆ. *U. S.* **Spirit of Peppermint.**

[ESSENCE OF PEPPERMINT.]

	Metric.	Old form.
Oil of Peppermint	100 C.c.	3 fl. oz. 96 min.
Peppermint, bruised	10 Gm.	146 grains.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Oil of Peppermint in 900 C.c. [old form 29 fl. oz.] of Alcohol, add the Peppermint, and macerate for twenty-four hours. Then filter through paper, and add, through the filter, enough Alcohol to make the Spirit measure 1000 C.c. [old form 2 pints].

SPIRITUS MENTHÆ VIRIDIS. *U. S.* Spirit of Spearmint.

[ESSENCE OF SPEARMINT.]

	Metric.	Old form.
Oil of Spearmint	100 C.c.	8 fl. oz. 96 min.
Spearmint, bruised	10 Gm.	146 grains.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Oil of Spearmint in 900 C.c. [old form 29 fl. oz.] of Alcohol, add the Spearmint, and macerate for twenty-four hours. Then filter through paper, and add, through the filter, enough Alcohol to make the Spirit measure 1000 C.c. [old form 2 pints].

SPIRITUS MYRCIÆ. *U. S.* Spirit of Myrcia.

[BAY RUM.]

	Metric.	Old form.
Oil of Myrcia	16 C.c.	4 fl. dr.
Oil of Orange Peel	1 C.c.	15 minims.
Oil of Pimenta	1 C.c.	15 minims.
Alcohol	1220 C.c.	89 fl. oz.
Water, a sufficient quantity,		
To make	2000 C.c.	4 pints.

Mix the Oils with the Alcohol, and gradually add Water until the solution measures 2000 C.c. [old form 4 pints]. Set the mixture aside, in a well-stoppered bottle, for eight days, then filter it through paper, in a well-covered funnel.

SPIRITUS MYRISTICÆ. *U. S.* Spirit of Nutmeg.

[ESSENCE OF NUTMEG.]

	Metric.	Old form.
Oil of Nutmeg	50 C.c.	1 fl. oz.
Alcohol	950 C.c.	19 fl. oz.
To make	1000 C.c.	20 fl. oz.

Mix them.

SPIRITUS PHOSPHORI. *U. S.* Spirit of Phosphorus.

[TINCTURE OF PHOSPHORUS.]

	Metric.	Old form.
Phosphorus	1.2 Gm.	17½ grains.
Absolute Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Weigh the Phosphorus in a tared capsule containing water, then dry it carefully and quickly with blotting paper, and introduce it into a flask containing 1000 C.c. [old form 2 pints] of Absolute Alcohol. Connect the flask with an upright condenser, supplied with cold water, and apply the heat of a water-bath, so that the Alcohol

may be kept gently boiling, until the Phosphorus is dissolved. Then allow the liquid to become cold, and, if necessary, add to it enough Absolute Alcohol to make it measure 1000 C.c. [old form 2 pints]. Lastly, transfer the Spirit to small, dark amber-colored vials, which should be securely stoppered, and kept in a cool and dark place.

SPIRITUS VINI GALLICI. *U. S.* Brandy.

An alcoholic liquid obtained by the distillation of the fermented, unmodified juice of fresh grapes, and at least four years old.

A pale, amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction.

Its specific gravity should not be more than 0.941, nor less than 0.925, corresponding, approximately, to an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume.

If 100 C.c. of Brandy be very slowly evaporated in a tared capsule on a water-bath, the last portions volatilized should have an agreeable odor free from harshness (absence of *fusel oil from grain* or *potato spirit*); and the residue, when dried at 100° C. (212° F.), should not weigh more than 1.5 Gm. This residue should have no sweet or distinctly spicy taste (absence of *added sugar*, *glycerin*, or *aromatic substances*). It should almost completely dissolve in 10 C.c. of cold water, forming a solution which is colored not deeper than light green by a few drops of dilute ferric chloride T.S. made by mixing the latter with 10 volumes of water (absence of more than traces of *oak tannin* from casks).

To render 100 C.c. of Brandy distinctly alkaline to litmus should require not more than 1 C.c. of potassium hydrate V.S. (limit of *free acid*).

For comments upon Spiritus Vini Gallici, see Part V.

Elixiria. *Elixirs.*

Elixirs are aromatic, sweetened, spirituous preparations, containing small quantities of active medicinal substances. Although they are largely employed throughout the United States, but two have been made official,—aromatic elixir and elixir of phosphorus. The former is intended as a vehicle for the administration of active remedies in small doses. There will be found in the Appendix a number of formulas of unofficial elixirs.

ELIXIR AROMATICUM. *U. S.* Aromatic Elixir.

	Metric.	Old form.
Compound Spirit of Orange	12 C.c.	185 minims.
Syrup	375 C.c.	12 fl. oz.
Precipitated Calcium Phosphate	15 Gm.	½ oz. av.
Deodorized Alcohol,		
Distilled Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Compound Spirit of Orange add enough Deodorized Alcohol to make 250 C.c. [old form 8 fl. oz.]. To this solution add the Syrup in several portions, agitating after each addition, and afterwards add, in the same manner, 375 C.c. [old form 12 fl. oz.] of Distilled Water. Mix the Precipitated Calcium Phosphate intimately with the liquid, and then filter through a wetted filter, returning the first portions of the filtrate until a transparent liquid is obtained. Lastly, wash the

filter with a mixture of 1 volume of Deodorized Alcohol and 3 volumes of Distilled Water, until the product measures 1000 C.c. [old form 2 pints].

ELIXIR PHOSPHORI. *U. S.* **Elixir of Phosphorus.**

	Metric.	Old form.
Spirit of Phosphorus	210 C.c.	6 fl. oz. 6 fl. dr.
Oil of Anise	2 C.c.	80 minims.
Glycerin	550 C.c.	17½ fl. oz.
Aromatic Elixir, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Spirit of Phosphorus, contained in a graduated bottle, add the Oil of Anise and Glycerin, and mix them by repeatedly inverting the bottle, until they form a clear liquid. Then add Aromatic Elixir, in several portions, gently agitating after each addition, until a transparent liquid is obtained, and the product measures 1000 C.c. [old form 2 pints]. Keep the product in dark amber-colored, well-stoppered bottles, in a cool and dark place.

Each cubic centimeter of Elixir of Phosphorus represents about *one-fourth milligramme* (0.00025 Gm.) of phosphorus.

QUESTIONS ON CHAPTER XXIII.

ALCOHOLIC SOLUTIONS.

In pharmacy, what are spirits?
In how many different ways are the official spirits made?
How many of them are there?
What is the most usual method of making them?
How many of them are made in this way?
In making spirits, what is the object of maceration?
What spirit is made by gaseous solution? By chemical reaction?
What official spirits are made by distillation?
Where spirits can be made either by distillation or by solution, which is the better process, and why?
Give the formula and process for making spirit of ether. Hoffmann's anodyne.
What is the official name in Latin and in English?
What is spirit of nitrous ether?
How much of the crude ether does it contain?
What is the formula in symbols of ethyl nitrite?
What is its molecular weight?
How is this obtained?
What is its popular name or synonyme?
How is it made?
What is spirit of ammonia?
How is it prepared?
What percentage of gas by weight does it contain?
What is the formula in symbols of ammonia?
What is its molecular weight?
Which is the stronger of the two preparations, spiritus ammoniæ or aqua ammoniæ?
What is aromatic spirit of ammonia?
How is it prepared?

What is the Latin name of spirit of bitter almond?
What is its popular name or synonyme?
How is it made? For what is it used?
Give the official name, formula, and mode of making spirit of anise. Spirit of orange. Compound spirit of orange. Spirit of camphor. Spirit of chloroform. Spirit of cinnamon.
What is whiskey? (as official in the U. S. P.)
Give the formula and mode of making spirit of gaultheria.
What is the Latin name of spirit of glonoin?
What is its popular name or synonyme?
How much glonoin does it contain?
What is the chemical name of glonoin?
Why should great care be exercised in using this preparation?
What is the specific gravity of spirit of glonoin? Spirit of juniper? Compound spirit of juniper? Spirit of lavender? Spirit of lemon?
What is the popular name of spirit of lemon?
Give the formula and mode of making spirit of peppermint.
What is its popular name?
Give the formula and mode of making spirit of spearmint.
What is the official name of bay rum, in Latin and in English?
How is it made?
Give the formula and mode of making spirit of nutmeg.
How is spirit of phosphorus made?
How much phosphorus does it contain?
What is the official definition of brandy?
How much alcohol does it contain?
What are elixirs?
What is aromatic elixir used for?
How is it made?

CHAPTER XXIV.

ETHEREAL SOLUTIONS.

Collodia. *Collodions.*

COLLODIONS are liquid preparations intended for external use, having for their base a solution of pyroxylin, or gun-cotton, in a mixture of ether and alcohol. (For a description of the properties of pyroxylin and collodions, see Part V.) Collodions are applied to the skin by means of a soft brush, and when the ether and alcohol evaporate, a film is left on the surface, which either acts as a protection or brings a medicating agent in contact with the epidermis. *Four* collodions are official.

Official Collodions.

Name.	Proportions.
Collodium.	30 Gm. Pyroxylin; 750 C.c. Stronger Ether; 250 C.c. Alcohol. Decant the clear Collodion from the sediment.
Collodium Cantharidatum.	60 Gm. Cantharides, No. 60 Powder; 85 Gm. Flexible Collodion; Commercial Chloroform sufficient to exhaust the Cantharides; after distillation the residue should weigh 15 Gm. Decant the clear Cantharidal Collodion from the sediment.
Collodium Flexile.	920 Gm. Collodion; 50 Gm. Canada Turpentine; 30 Gm. Castor Oil.
Collodium Stypticum.	20 Gm. Tannic Acid; 5 C.c. Alcohol; 25 C.c. Ether; Collodion, to make 100 C.c.

COLLODIUM. *U.S.* **Collodion.**

	Metric.	Old form.
Pyroxylin	30 Gm.	1 oz. av.
Ether	750 C.c.	24 fl. oz.
Alcohol	250 C.c.	8 fl. oz.
		2 pints.

To the Pyroxylin, contained in a suitable bottle, add the Ether, and let it stand for fifteen minutes; then add the Alcohol, and shake the bottle until the Pyroxylin is dissolved. Cork the bottle well, and set it aside until the liquid has become clear. Then decant the clear portion from any sediment which may have formed, and transfer it to bottles, which should be well corked.

Keep the Collodion in cork-stoppered bottles, in a cool place, remote from lights or fire.

COLLODIUM CANTHARIDATUM. U. S. Cantharidal Collodion.

[BLISTERING COLLODION.]

	Metric.	Old form.
Cantharides, in No. 60 powder	60 Gm.	2 oz. av. 50 grains.
Flexible Collodion	85 Gm.	3 oz. av.
Chloroform, a sufficient quantity,		
To make	100 Gm.	3 oz. av. 230 grains.

Pack the Cantharides firmly in a cylindrical percolator, and gradually pour Chloroform upon it, until the powder is exhausted. Recover the Chloroform by distillation from a water-bath, and evaporate the residue, in a capsule, on a water-bath, until it weighs 15 Gm. [old form 231 grains]. Dissolve this in the Flexible Collodion, and set it aside to become clear by settling. Finally pour off the clear portion from any sediment which may have formed, and transfer it to bottles, which should be securely corked.

Keep the Cantharidal Collodion in cork-stoppered bottles, in a cool place, remote from lights or fire.

COLLODIUM FLEXILE. U. S. Flexible Collodion.

	Metric.	Old form.
Collodion	920 Gm.	8 oz. av.
Canada Turpentine	50 Gm.	190 grains.
Castor Oil	30 Gm.	115 grains.
To make	1000 Gm.	about 9 oz. av.

Weigh the ingredients, successively, into a tared bottle, and mix them thoroughly.

Keep the product in cork-stoppered bottles, in a cool place, remote from lights or fire.

COLLODIUM STYPTICUM. U. S. Styptic Collodion.

	Metric.	Old form.
Tannic Acid	20 Gm.	308 grains.
Alcohol	5 C.c.	80 minims.
Ether	25 C.c.	405 minims.
Collodion, a sufficient quantity,		
To make	100 C.c.	3 fl. oz. 183 min.

Introduce the Tannic Acid, Alcohol, and Ether into a graduated bottle, agitate until the Tannic Acid is thoroughly incorporated and partially dissolved, then add enough Collodion to make up the volume to 100 C.c. [old form 3 fl. oz. 183 min.], and shake occasionally, until the Acid is completely dissolved.

Keep the product in cork-stoppered bottles, in a cool place, remote from lights or fire.

CHAPTER XXV.

OLEAGINOUS SOLUTIONS OR EXTERNAL APPLICATIONS.

Linimenta. *Liniments.*

THESE are solutions of various substances or mixtures in oily or alcoholic liquids containing fatty oils, intended for external application, and usually applied with friction and rubbing of the skin. There are *nine* official liniments, of which *three* are made with a fixed oil as the base, *five* with alcohol as the principal liquid, and *one* contains oil of turpentine. They are classified as follows:

Official Liniments.

Name.	Base.	Proportions.
Linimentum Ammoniæ.	Oil.	350 C.c. Ammonia Water; 50 C.c. Alcohol; 600 C.c. Cotton Seed Oil.
Linimentum Calcis.	Oil.	Equal volumes Solution of Lime and Linseed Oil.
Linimentum Camphoræ.	Oil.	200 Gm. Camphor; 800 Gm. Cotton Seed Oil.
Linimentum Belladonnæ.	Alcohol.	50 Gm. Camphor; 950 C.c. Fluid Extract of Belladonna.
Linimentum Chloroformi.	Alcohol.	300 C.c. Chloroform; 700 C.c. Soap Liniment.
Linimentum Saponis.	Alcohol.	70 Gm. Powdered Soap; 45 Gm. Camphor; 10 C.c. Oil of Rosemary; 750 C.c. Alcohol; Water, to make 1000 C.c.
Linimentum Saponis Mollis.	Alcohol.	650 Gm. Soft Soap; 20 C.c. Oil of Lavender Flowers; 300 C.c Alcohol; Water, to make 1000 C.c.
Linimentum Sinapis Compositum.	Alcohol.	30 C.c. Volatile Oil of Mustard; 200 C c. Fluid Extract of Mezereum; 60 Gm. Camphor; 150 C.c. Castor Oil; Alcohol, to make 1000 C.c.
Linimentum Terebinthinæ.	Oil of Turpentine.	650 Gm. Resin Cerate; 350 Gm. Oil of Turpentine.

PRACTICAL PROCESSES FOR OFFICIAL LINIMENTS.

LINIMENTUM AMMONIÆ. *U.S.* Ammonia Liniment.

[VOLATILE LINIMENT.]

	Metric.	Old form.
Ammonia Water	350 C.c.	11 fl. oz.
Alcohol	50 C.c.	2 fl. oz.
Cotton Seed Oil	600 C.c.	19 fl. oz.
To make	1000 C.c.	2 pints.

Mix them by agitation in a bottle, which should be well stoppered. This Liniment should be freshly prepared, when wanted.

LINIMENTUM BELLADONNÆ. *U.S.* Belladonna Liniment.

	Metric.	Old form.
Camphor	50 Gm.	780 grains.
Fluid Extract of Belladonna, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Camphor in about 200 C.c. [old form 6½ fl. oz.] of the Fluid Extract, and then add enough of the latter to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

LINIMENTUM CALCIS. *U.S.* Lime Liniment.

[Carron Oil.]

Solution of Lime,
Linseed Oil, of each, one volume.

Mix them by agitation.

LINIMENTUM CAMPHORÆ. *U.S.* Camphor Liniment.

	Metric.	Old form.
Camphor, in coarse powder	200 Gm.	2 oz. av.
Cotton Seed Oil	800 Gm.	8 oz. av.
To make	1000 Gm.	10 oz. av.

Introduce the Camphor and the Cotton Seed Oil into a suitable flask, and apply a gentle heat, by means of a water-bath, loosely stoppering the flask during the operation. Agitate from time to time, until the Camphor is dissolved.

LINIMENTUM CHLOROFORMI. *U.S.* Chloroform Liniment.

	Metric.	Old form.
Chloroform	300 C.c.	9½ fl. oz.
Soap Liniment	700 C.c.	22½ fl. oz.
To make	1000 C.c.	2 pints.

Mix them by agitation.

LINIMENTUM SAPONIS. *U.S.* Soap Liniment.

	Metric.	Old form.
Soap, in fine powder	70 Gm.	2 oz. av. 147 gr.
Camphor, in small pieces	45 Gm.	1 oz. av. 220 gr.
Oil of Rosemary	10 C.c.	158 minims.
Alcohol	750 C.c.	24 fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Introduce the Camphor and the Alcohol into a suitable bottle, and shake until the Camphor is dissolved. Then add the Soap and Oil of

Rosemary, and shake the bottle well for a few minutes. Lastly, add enough Water to make 1000 C.c. [old form 2 pints], and again shake until the liquid becomes clear. Set it aside, in a cool place, for twenty-four hours, then filter.

LINIMENTUM SAPONIS MOLLIS. *U. S.* **Liniment of Soft Soap.**

[TINCTURA SAPONIS VIRIDIS, PHARM. 1880.]

	Metric.	Old form.
Soft Soap	650 Gm.	21½ oz. av.
Oil of Lavender	20 C.c.	5 fl. dr.
Alcohol	300 C.c.	9½ fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Oil of Lavender with the Alcohol, dissolve in this the Soft Soap by stirring or agitation, and set the solution aside for twenty-four hours. Then filter it through paper, and pass enough Water through the filter to make the product measure 1000 C.c. [old form 2 pints]. Mix thoroughly.

LINIMENTUM SINAPIS COMPOSITUM. *U. S.* **Compound Liniment of Mustard.**

	Metric.	Old form.
Volatile Oil of Mustard	30 C.c.	230 minims.
Fluid Extract of Mezereum	200 C.c.	3 fl. oz. 96 min.
Camphor	60 Gm.	1 oz. av.
Castor Oil	150 C.c.	2½ fl. oz.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Dissolve the Camphor in 500 C.c. [old form 8 fl. oz.] of Alcohol, and add the Fluid Extract of Mezereum; then add the Oil of Mustard and the Castor Oil and, finally, enough Alcohol to make the product measure 1000 C.c. [old form 1 pint]. Mix thoroughly.

LINIMENTUM TEREBINTHINÆ. *U. S.* **Turpentine Liniment.**

	Metric.	Old form.
Resin Cerate	650 Gm.	13 oz. av.
Oil of Turpentine	350 Gm.	7 oz. av.
To make	1000 Gm.	20 oz. av.

Melt the Resin Cerate in a capsule, on a water-bath, then add the Oil of Turpentine, and mix them thoroughly.

Oleata. *Oleates.*

The official oleates are liquid preparations made by dissolving metallic salts or alkaloids in oleic acid. The term oleate is also used commercially to designate solid preparations which are supposed to be chemical compounds of oleic acid with various bases. (See Part V.)

The official oleates are not assumed to be definite chemical compounds. The proportion of oleic acid is excessive, and they must be regarded as solutions of the medicating agent in oleic acid, the latter having special advantages as a basis for administering external remedies, being more readily absorbed than most of the fatty substances used in making ointments. *Three* oleates are official.

Official Oleates.

Name.	Proportions.
Oleatum Hydrargyri.	200 Gm. Yellow Mercuric Oxide; 800 Gm. Oleic Acid.
Oleatum Veratrinæ.	2 Gm. Veratrine; 98 Gm. Oleic Acid.
Oleatum Zinci.	50 Gm. Zinc Oxide; 950 Gm. Oleic Acid.

OLEATUM HYDRARGYRI, *U.S.* Oleate of Mercury.

	Metric.	Old form.
Yellow Mercuric Oxide, thoroughly dried	200 Gm.	2 oz. av.
Oleic Acid	800 Gm.	8 oz. av.
To make	1000 Gm.	10 oz. av.

Introduce the Oleic Acid into a capacious mortar, and gradually add to it the Yellow Mercuric Oxide by sifting it upon the surface of the Acid, and incorporate it by continuous stirring. Then set the mixture aside in a warm place, at a temperature not exceeding 40° C. (104° F.), and stir frequently, until the Oxide is dissolved.

OLEATUM VERATRINÆ. *U.S.* Oleate of Veratrine.

	Metric.	Old form.
Veratrine	2 Gm.	85 grains.
Oleic Acid	98 Gm.	3 oz. av. 402 gr.
To make	100 Gm.	4 oz. av.

Rub the Veratrine with a small quantity of Oleic Acid, in a warm mortar, to a smooth paste. Then add the remainder of the Oleic Acid, previously warmed, and stir frequently, until the Veratrine is dissolved.

OLEATUM ZINCI. *U.S.* Oleate of Zinc.

	Metric.	Old form.
Zinc Oxide	50 Gm.	1 oz. av.
Oleic Acid	950 Gm.	19 oz. av.
To make	1000 Gm.	20 oz. av.

Introduce the Oleic Acid into a capacious capsule, and gradually add to it the Zinc Oxide by sifting it upon the surface of the Acid, and incorporate it by continuous stirring. Set the mixture aside for a few hours, and then heat it on a water-bath, frequently stirring, until the Oxide is dissolved.

QUESTIONS ON CHAPTERS XXIV. AND XXV.

ETHEREAL SOLUTIONS, OLEAGINOUS SOLUTIONS OR EXTERNAL APPLICATIONS.

What are collodions, and how are they used?
How many are official, and what are their names?
Give the formula and mode of making collodion.
What is the official name of cantharidal collodion?
Give its formula and mode of preparation.
What is flexible collodion?
Give its formula and mode of preparation.
What is styptic collodion?
Give its formula and mode of preparation.
What are liniments?
How many are official?
What substances are used as the bases for these liniments?
How is ammonia liniment made?
What is its popular name or synonyme?
Give the formula and mode of making belladonna liniment. Lime liniment. What is this sometimes called? Camphor liniment. Chloroform liniment. Soap liniment.
What kind of soap should be used?
What is the Latin name of liniment of soft soap?
What was its official name in the U. S. P. 1880?
How is it made?
Give the formula and mode of making compound liniment of mustard. Turpentine liniment.
What are official oleates?
How many are there, and what are their names?
What advantage are they supposed to possess over the fatty substances that are commonly used in ointments?
Give the formula and mode of making oleate of mercury. Oleate of veratrine. Oleate of zinc.

CHAPTER XXVI.

AQUEOUS LIQUIDS MADE BY PERCOLATION OR MACERATION.

Infusa. *Infusions.*

INFUSIONS are liquid preparations made by treating vegetable substances with either hot or cold water. *The drug is not subjected to the boiling process,* although it is common to pour boiling water over it; the whole is allowed to stand in a close vessel until cold. Whilst the use of hot water has the advantage of saving time in some cases, it is often objectionable because the *inert* principles in the drug are dissolved by the hot water, and as the infusion cools, they are precipitated out in such a very finely divided condition that they cannot be readily separated by colation or filtration. Cold water should be selected as the menstruum when the drug contains a valuable volatile principle, when the active agent is injured by heat, or when the desirable principles are readily soluble in water of ordinary temperature. The time required to make the infusion must be considered, for in warm weather it is quite possible for an infusion to ferment or decompose before it is finished.

Pure water should be used in making infusions, and large quantities should not be made at one time unless demanded for immediate use, as, without special precautions to preserve them, they soon become decomposed.

Of the inert principles found in plants, starch is extracted by hot water and albumen by cold water, whilst gum, sugar, and extractive are dissolved by both.

In making infusions the drug is usually coarsely comminuted, sliced, or bruised. Fine powders should be avoided whenever possible, because it is difficult to separate the fine particles from the infusion; and if percolation is resorted to, so much time is consumed in the operation, owing to the swelling of the powder, that decomposition may set in before the preparation is finished. The number of official infusions is *four*. Infusions are usually made in four ways: 1. By maceration. 2. By digestion. 3. By percolation. 4. By diluting fluid extracts.

1. **By Maceration.**—This is the process which is most frequently used. The general formula of the U. S. Pharmacopœia, which is here appended, furnishes a model.

GENERAL OFFICIAL FORMULA FOR INFUSIONS.

An ordinary Infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:

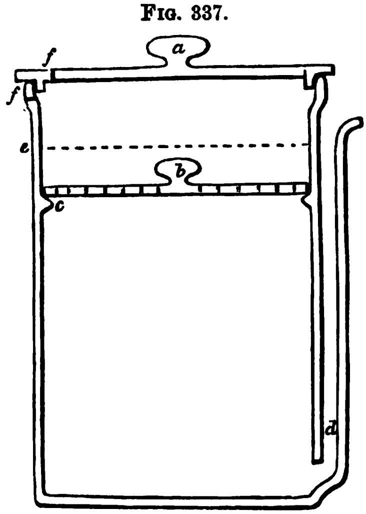
Take of	Metric.	Old form.
The Substance, coarsely comminuted	50 Gm.	865 grains.
Boiling Water	1000 C.c.	1 pint.
Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Put the substance into a suitable vessel provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand for half an hour. Then strain, and pass enough Water through the strainer to make the Infusion measure 1000 C.c. [old form 1 pint].

Caution.—The strength of Infusions of energetic or powerful substances should be specially prescribed by the physician.

It will be found most convenient to provide special apparatus for making infusions by maceration. One of the oldest forms is known as *Alsop's Infusion Jar.* This presents a very neat and effectual method of making the hot infusions. It consists of an earthen-ware mug, represented in Fig. 337, with a spout, *d*, proceeding from the bottom, and placed closely to the side of the vessel to prevent fracture; a perforated plate or diaphragm, *b*, supported on a ledge, *c*, at about one-quarter or one-third of the height of the vessel from the top; and a lid, *a*, which may be fastened on by a string through holes *f f*. The material to be submitted to infusion is placed on the perforated plate, and the hot water poured in so as to cover it, the vessel having been previously warmed, so as not to chill the liquid. As the water becomes impregnated, it acquires an increased specific gravity, and sinks to the bottom, its place being supplied by the unsaturated portion; and this circulation goes on until the whole of the soluble matter is extracted. In order to maintain a due warmth, the vessel may be placed upon a stove, or upon an iron plate near the fire. The advantage of the process is that the material is subjected to the solvent power of the least impregnated portion of the menstruum. In order that the vessel may be adapted for the preparation of different quantities of infusions, it would be an advantage to have ledges arranged within, at different heights, so that the diaphragm may be supported at any desired point. The surface of the liquid, *e*, should of course always be above the medicinal substance. Tinned iron or metallic vessels are unsuited for infusions; they are particularly objectionable when the drug used for making the preparation contains tannin, gallic acid, or an astringent substance. The liability of iron vessels to rust constitutes another objection.

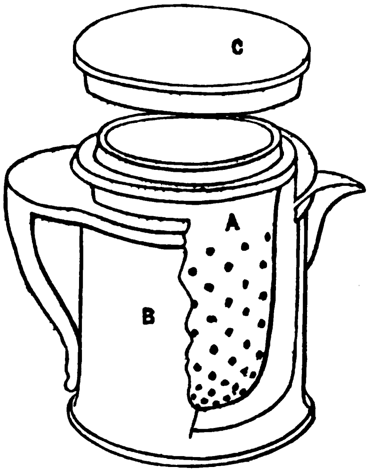
FIG. 337.



Alsop's infusion jar.

Squire's Infusion Mug differs from the preceding in having a colander of queen's-ware, which is closely covered with a lid, and descends into the jar so as to form a diaphragm for the support of the substance to be infused. It has the advantage that the material, after having been exhausted, may be lifted out without disturbing the infusion. Fig. 338 shows the mug. It is made of queen's-ware, of the capacity of one pint, B: into it a thimble-shaped colander, A, descends, supported on the rim of the mug by a projecting ledge, with a carefully-fitted cover, C, which closes the whole. The substance to be submitted to infusion is introduced into the colander either before or after it has been fitted to the mug; the water, hot or cold, as the case may be, is then poured in so as to fill the lower vessel and cover the materials in the upper; and, the cover having been applied, the vessel is set aside for the length of time required. The colander is then to be lifted out, and the infusion, without having to strain it, is ready for use.

FIG. 338.



Squire's infusion mug.

FIG. 339.

Infusion pitcher.

FIG. 340.

Infusion mug (home-made).

Fig. 339 represents an earthen-ware infusion pitcher, which may be used for making a gallon of infusion: it is useful where there is a large demand. Its principle of action is similar to that of Squire's infusion mug. A still better and cheaper apparatus may be made by the pharmacist himself, by selecting a queen's-ware or porcelain tea- or coffee-pot, A, as in Fig. 340, and if a hole is bored with the broken end of a small file through the top, close to the handle, a copper wire may be passed through the hole and around the handle, and made to terminate in a hook. The material to be infused is loosely tied up in a square piece of cheese-cloth (coarse, thin muslin) and suspended from the hook: the hot water soon penetrates all parts of the drug and dissolves out the soluble principles by circulatory displacement. This method has the great advantage that no further straining is needed, as the bag retains all of the solid undissolved portion; this may be pressed and the contents thrown away.

Official Infusions made by Maceration.

Name.	Proportion.	Use and Dose.
Infusum Digitalis.	15 Gm. Digitalis; 150 C.c. Cinnamon Water; 100 C.c. Alcohol; 500 C.c. Boiling Water; Cold Water, to make 1000 C.c.	Diuretic, etc., f℥iv.
Infusum Sennæ Compositum.	60 Gm. Senna; 120 Gm. Manna; 120 Gm. Magnesium Sulph.; 20 Gm. Fennel; 800 C.c. Boiling Water; Cold Water, to make 1000 C.c	Purgative, f℥ij to f℥iv.

2. **By Digestion.**—The process of *digestion* consists in subjecting the substance to the continued action of moderate heat below the boiling temperature. In making infusions digestion is often very useful, although it may not be directed in the formula. It generally suffices to place the infusion vessel (see Fig. 340) upon a moderately hot portion of the stove-plate, or upon the floor near the stove or source of heat.

3. **By Percolation.**—This method of making infusions is by far the most satisfactory, and should be used whenever possible. It should be selected when the desirable principles are easily dissolved in water, and when the amount of menstruum is amply sufficient to exhaust the drug thoroughly. Percolation presents the advantages of furnishing a finished preparation, straining being unnecessary. Again, precipitation from the deposition of inert principles after the infusion has been strained, due to the principles being soluble in hot water but insoluble in cold water, is avoided. The chief drawback to the adoption of percolation in making infusions is the length of time it takes to exhaust the drug with water. Infusions are generally extemporaneous preparations, and they are frequently desired quickly: hence the process of maceration is often selected in preference.

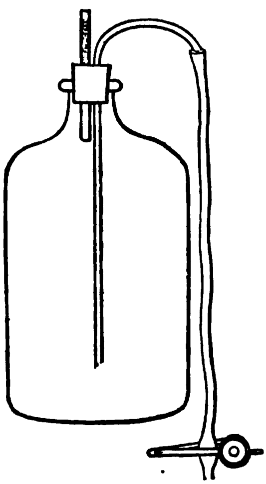
Official Infusions made by Percolation.

Name.	Proportion.	Use.
Infusum Cinchonæ.	60 Gm. Cinchona; 10 C.c. Aromatic Sulphuric Acid; Water, to make 1000 C.c.	Tonic.
Infusum Pruni Virginianæ.	40 Gm. Wild Cherry Bark; Water, to make 1000 C.c.	Tonic.

Preservation of Infusions.—The difficulty in preserving infusions arises from the decomposition of the principles which are extracted by water and retained in the preparation. If sufficient alcohol is added to prevent decomposition, the therapeutic action of the infusion is usually interfered with, owing to the comparatively large proportion of spirit contained in the dose. Alcohol is successfully used in preparations like infusion of gentian, orange peel, etc., or simple tonics. If an antiseptic, like boric, carbolic, or salicylic acid, is used, the same objection exists,—the interference due to the therapeutic action of the antiseptic.

It has been proved that infusions may be preserved for a long time, if they are protected from the microscopic organisms which float in the air. A simple method is to heat the infusion contained in the bottle gradually to the boiling-point, in order to destroy any of the spores that may be present, and then to transfer it at once to small bottles, which are filled to the brim, the corks forced in and tied over, and the cork, lip, and neck of each bottle dipped into hot sealing-wax. A useful modification of Almen's method consists in heating to the boiling-point the infusion contained in a bottle in a water-bath. The rubber cork of the bottle is perforated so as to admit a long bent tube and a short tube; the short tube is loosely filled with cotton, the long limb of the bent tube is passed through the cork, and a rubber tube with a pinch-cock attached, as shown in Fig. 341. The cotton permits the admission of air into the bottle, but excludes spores and dust. The infusion may be drawn as wanted from the bottle by the rubber tube and syphon, the flow being controlled by the pinch-cock and started by suction.

Fig. 341.



Infusion bottle.

Infusions from Fluid Extracts.—The habit of making infusions from concentrated alcoholic tinctures or fluid extracts is improper and unjustifiable, except in those few cases in which the active and desirable principles of the drug are equally soluble in alcohol and in water, or in the menstrua used for both fluid extract and infusion. This is well illustrated in those preparations in which the activity of the drug is due to resinous bodies. Alcoholic menstrua here are necessary to dissolve the resins, and if such a fluid extract is added to water, precipitation takes place and the filtered infusion is worthless. If the precipitate is inert or does not carry down with it any portion of the active principle, and is readily separated, the only objection to the infusion is the presence of the alcohol, which may or may not seriously interfere with the therapeutic action, according as the quantity present is large or small. The saving in time and labor by making infusions in this way is the cause of the frequent employment of this method, but it should never be used if the therapeutic action of the drug is weakened thereby. The substitution of a fluid extract infusion in a prescription for one directed to be made by the officinal process is very reprehensible.

PRACTICAL PROCESSES FOR OFFICIAL INFUSIONS.

INFUSA. Infusions.

General Official Formula.—An ordinary infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:

Take of	Metric.	Old form.
The Substance, coarsely comminuted	50 Gm.	865 grains.
Boiling Water	1000 C.c.	16 fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Put the substance into a suitable vessel, provided with a cover, pour upon it the Boiling Water, cover the vessel tightly, and let it stand for half an hour. Then strain, and pass enough Water through the strainer to make the Infusion measure 1000 C.c. [old form 1 pint].

Caution.—The strength of infusions of energetic or powerful substances should be specially prescribed by the physician.

INFUSUM CINCHONÆ. *U.S.* Infusion of Cinchona.

	Metric.	Old form.
Cinchona, in No. 40 powder	60 Gm.	2 oz. av.
Aromatic Sulphuric Acid	10 C.c.	146 minims.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Acid with 500 C.c. [old form 16 fl. oz.] of Water, and moisten the powder with 30 C.c. [old form 1 fl. oz.] of the mixture; pack it firmly in a conical glass percolator, and gradually pour upon it, first, the remainder of the mixture, and afterwards Water, until the Infusion measures 1000 C.c. [old form 2 pints].

INFUSUM DIGITALIS. *U.S.* Infusion of Digitalis.

	Metric.	Old form.
Digitalis, bruised	15 Gm.	½ oz. av.
Alcohol	100 C.c.	3½ fl. oz.
Cinnamon Water	150 C.c.	5 fl. oz.
Boiling Water	500 C.c.	16 fl. oz.
Cold Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Upon the Digitalis, contained in a suitable vessel, pour the Boiling Water, and allow it to macerate until the mixture is cold. Then strain, add the Alcohol and Cinnamon Water to the strained liquid, and pass enough Cold Water through the residue on the strainer to make the product measure 1000 C.c. [old form 2 pints].

INFUSUM PRUNI VIRGINIANÆ. *U.S.* Infusion of Wild Cherry.

	Metric.	Old form.
Wild Cherry, in No. 20 powder	40 Gm.	584 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 60 C.c. [old form 2 fl. oz.] of Water, and macerate for one hour; then pack it firmly in a conical glass percolator, and gradually pour Water upon it until the Infusion measures 1000 C.c. [old form 2 pints].

INFUSUM SENNÆ COMPOSITUM. *U.S.* **Compound Infusion of Senna.**

[BLACK DRAUGHT.]

	Metric.	Old form.
Senna	60 Gm.	2 oz. av.
Manna	120 Gm.	4 oz. av.
Magnesium Sulphate	120 Gm.	4 oz. av.
Fennel, bruised	20 Gm.	292 grains.
Boiling Water	800 C.c.	25 fl. oz.
Cold Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Upon the Senna and Fennel, contained in a suitable vessel, pour the Boiling Water, and macerate until the mixture is cold. Then strain with expression, dissolve in the infusion the Magnesium Sulphate and Manna, and again strain. Lastly, add enough Cold Water through the strainer containing the Senna and Fennel to make the Infusion measure 1000 C.c. [old form 2 pints].

UNOFFICIAL INFUSIONS.

INFUSUM GENTIANÆ COMPOSITUM. *U. S. P.* 1870. **Compound Infusion of Gentian.**

	Metric.	U.S. 1870.
Gentian, in moderately coarse powder	16 Gm.	½ troy oz.
Bitter Orange Peel, in moderately coarse powder	4 Gm.	60 grains.
Coriander, in moderately coarse powder	4 Gm.	60 grains.
Alcohol	60 C.c.	2 fl. oz.
Water, a sufficient quantity.		

Mix the Alcohol with fourteen fluidounces of Water (435 C.c. metric), and, having moistened the mixed powders with three fluidrachms (12 C.c. metric) of the menstruum, pack them firmly in a conical percolator, and gradually pour upon them first the remainder of the menstruum, and afterwards Water, until the filtered liquid measures a pint (500 C.c. metric).

INFUSUM GENTIANÆ COMPOSITUM FORTIUS. Concentrated Compound Infusion of Gentian (quadruple strength).

	Metric.	U.S. 1870.
Gentian, in moderately coarse powder	64 Gm.	2 troy oz.
Bitter Orange Peel, in moderately coarse powder	16 Gm.	½ troy oz.
Coriander, in moderately coarse powder	16 Gm.	½ troy oz.
Alcohol	60 C.c.	2 fl. oz.
Water	435 C.c.	14 fl. oz.

Mix the Alcohol with the Water, and, having moistened the mixed powders with one fluidounce (30 C.c. metric) of the menstruum, pack them firmly in a conical percolator, and gradually pour upon them

first the remainder of the menstruum, and afterwards Water, until the filtered liquid measures a pint (500 C.c. metric). This preparation keeps well, is four times the strength of the U. S. P. 1870 infusion, and may be diluted with Water containing Alcohol in the same proportion (1 Alcohol, 7 Water) when Compound Infusion of Gentian is prescribed. If water alone is used to dilute it, a precipitate is apt to occur.

INFUSUM ROSÆ COMPOSITUM. *U. S.* 1870. **Compound Infusion of Rose.**

	Metric.	U. S. 1870.
Red Rose (dried petals)	16 Gm.	½ troy oz.
Diluted Sulphuric Acid	12 C.c.	3 fl. dr.
Sugar (in coarse powder)	48 Gm.	1½ troy oz.
Boiling Water	1250 C.c.	2½ pints.

Pour the Water upon the Rose, in a covered glass or porcelain vessel; add the Acid, and macerate for half an hour. Lastly, dissolve the Sugar in the liquid, and strain.

INFUSUM SALVIÆ. *U. S.* 1870. **Infusion of Sage.**

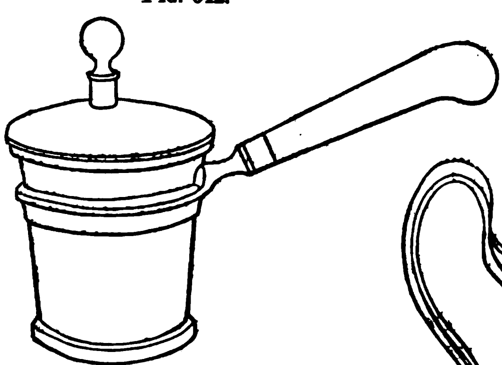
	Metric.	U. S. 1870.
Sage	16 Gm.	½ troy oz.
Boiling Water	500 C.c.	1 pint.

Macerate for half an hour in a covered vessel, and strain.

Decocta. *Decoctions.*

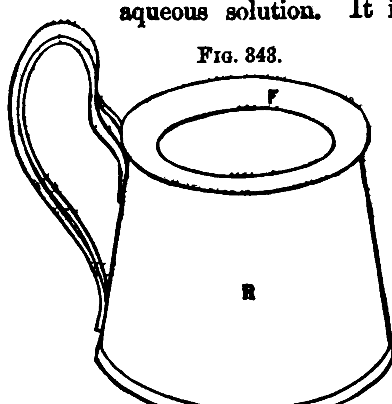
Decoctions are liquid preparations made by *boiling* vegetable substances with water. The object sought to be gained in preparing decoctions is to secure the soluble active principles of drugs which are not injured by heat in aqueous solution. It is obvious that very few drugs are suited to this form of administration; and decoctions are rapidly declining in favor. Hot infusion will generally afford a means of obtaining all the benefits that are derived from boiling the drug with water, whilst the prolonged action of boiling water generally exercises a dissociating effect upon the active principles. The disadvantages

FIG. 342.



Block-tin decoction vessel.

FIG. 343.



Brass water-bath.

of hot infusions are possessed in a more marked degree by decoctions (see page 344). In compound decoctions the ingredients are preferably added at different periods of the operation, the hard, ligneous drugs being added first, and the aromatics, or those containing volatile oils, at the close of the process, so that loss of activity of the latter may not ensue.

The earthen-ware or porcelain vessels used in preparing infusions are preferred for decoctions (see page 346), as they will bear the heat of boiling water, if heated gradually. Fig. 342 shows a block-tin vessel employed for preparing decoctions, used largely in Germany, and to some extent here. It is preferably used in connection with the brass water-bath, R (see Fig. 343). The rim, F, is somewhat flexible, whilst a small aperture permits the escape of steam. The empyreumatic odor which many decoctions possess when made over a naked fire, and caused by particles adhering to the bottom of the vessel and becoming charred, is avoided by the use of the water-bath.

Iron vessels are not used advantageously, because of the discoloration which is caused by the tannin of astringent drugs reacting with the iron.

The number of official decoctions is *two*.

PRACTICAL PROCESSES FOR OFFICIAL DECOCTIONS.

DECOCTA. Decoctions.

An ordinary Decoction, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula:

Take of	Metric.	Old form.
The Substance, coarsely comminuted	50 Gm.	365 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Put the substance into a suitable vessel provided with a cover, pour upon it 1000 C.c. [old form 1 pint] of cold Water, cover it well, and boil for fifteen minutes. Then let it cool to about 40° C. (104° F.), express, strain the expressed liquid, and pass enough cold Water through the strainer to make the product measure 1000 C.c. [old form 1 pint].

Caution.—The strength of Decoctions of energetic or powerful substances should be specially prescribed by the physician.

DECOCTUM CETRARIÆ. *U. S.* Decoction of Cetraria.

	Metric.	Old form.
Cetraria	50 Gm.	365 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Cover the Cetraria, in a suitable vessel, with 400 C.c. [old form 6½ fl. oz.] of cold Water, express after half an hour, and throw the liquid away. Then boil the Cetraria with 1000 C.c. [old form 1 pint] of Water for half an hour, strain, and add enough cold Water, through

the strainer, to make the product, when cold, measure 1000 C.c. [old form 1 pint].

DECOCTUM SARSAPARILLÆ COMPOSITUM. *U.S.* Compound Decoction of Sarsaparilla.

	Metric.	Old form.
Sarsaparilla, cut and bruised	100 Gm.	3 oz. av. 148 gr.
Sassafras, in No. 20 powder	20 Gm.	292 grains.
Guaiacum Wood, rasped	20 Gm.	292 grains.
Glycyrrhiza, bruised	20 Gm.	292 grains.
Mezereum, cut and bruised	10 Gm.	146 grains.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Boil the Sarsaparilla and Guaiacum Wood for half an hour in a suitable vessel with 1000 C.c. [old form 2 pints] of Water. Then add the Sassafras, Glycyrrhiza, and Mezereum, cover the vessel well, and macerate for two hours. Finally strain, and add enough cold Water, through the strainer, to make the product measure 1000 C.c. [old form 2 pints].

UNOFFICIAL DECOCTIONS.

DECOCTUM SARSAPARILLÆ COMPOSITUM FORTIUS. *P. G.* Zittmann's Decoction (Stronger).

	Metric.	Old form.
Sarsaparilla, cut	20 Gm.	2 oz. av.
Water	520 C.c.	50 fl. oz.

Digest for twenty-four hours, and, having added

	Metric.	Old form.
Sugar	1 Gm.	44 grains,
Alum	1 Gm.	44 grains,

expose them in a covered vessel, with occasional stirring, for three hours, to the heat of boiling water; then add to the mixture

	Metric.	Old form.
Anise, bruised	1 Gm.	44 grains.
Fennel, bruised	1 Gm.	44 grains.
Senna, cut	5 Gm.	½ oz. av.
Liquorice Root, cut	2 Gm.	88 grains.

Digest for a quarter of an hour, and strain the liquid with expression. Allow the Decoction to settle; then pour off the liquid, and, by the addition of water, bring it to 500 C.c. [or 3 pints].

DECOCTUM SARSAPARILLÆ COMPOSITUM MITIUS. *P. G.* Zittmann's Decoction (Milder).

	Metric.	Old form.
Sarsaparilla, cut	10 Gm.	1 oz. av.
Water	480 C.c.	46 fl. oz.

Digest for twenty-four hours, and expose in a covered vessel, with

occasional stirring, for three hours, to the heat of boiling water on a water-bath. Then add to the decoction:

	Metric.	Old form.
Lemon Peel, cut	1 Gm.	44 grains.
Cinnamon, bruised	1 Gm.	44 grains.
Cardamom, bruised	1 Gm.	44 grains.
Liquorice Root, cut	1 Gm.	44 grains.

Digest for a quarter of an hour, and strain the liquid with expression. Allow the Decoction to settle; then pour off the liquid, and, by the addition of water, bring it to 500 C.c. [or 3 pints].

QUESTIONS ON CHAPTER XXVI.

AQUEOUS LIQUIDS MADE BY PERCOLATION OR MACERATION.

What are infusions?
In making infusions, should the substances be boiled?
In what cases is hot water preferable? Cold water?
What inert principles found in drugs are extracted by hot water, and what by cold water?
What is the objection to using fine powders in making infusions?
How many official infusions are there?
By what four methods are infusions usually made?
Which process is most frequently used in the U. S. P.?
Give the general official formula for infusions.
Describe Alsop's infusion jar. Squire's infusion mug.
What special advantage has this mug?
How may a cheap and convenient apparatus be made?
What official infusions are made by maceration?
How is the process of digestion used in making infusions?
Is percolation a good process for making infusions?
What are its advantages?
What is its chief disadvantage?
What official infusions are made by percolation?
How may infusions be preserved?
What is the objection to the use of antiseptics?
Describe Almen's method of preserving infusions.
Is the method of making infusions from fluid extracts a desirable one?
What are the objections to it?
Give the formula and mode of making infusion of cinchona.
Give the formula and mode of making infusion of digitalis. Infusion of wild cherry. Compound infusion of senna.
What is the popular name or synonyme of this preparation?
Give the formula and mode of making compound infusion of gentian.
What are decoctions?
What is the object sought in preparing decoctions?
What are the disadvantages attending decoctions?
In making decoctions, should all the ingredients be put in together? Why?
How may the empyreumatic odor which sometimes occurs in decoctions be avoided?
Are iron vessels used advantageously in making decoctions? Why?
How many official decoctions are there, and what are their names?
Give the general official formula for making a decoction, where the strength has not been directed or specified
Give the Latin name, formula, and mode of making decoction of cetraria. Compound decoction of sarsaparilla. Zittmann's stronger decoction. Zittmann's milder decoction.
In what pharmacopœia are the last two official?

CHAPTER XXVII.

ALCOHOLIC LIQUIDS MADE BY PERCOLATION OR MACERATION.

Tincturæ. *Tinctures.*

TINCTURES are alcoholic solutions of medicinal substances. They differ from spirits in being made from *non-volatile* bodies, there being but one official exception to this rule.[1] They are made by percolation, maceration, solution, or dilution, and the menstrua employed in the official tinctures are alcohol, diluted alcohol of various strengths, aromatic spirit of ammonia, or mixtures of alcohol, water, and glycerin. The official tinctures are *seventy-two* in number. In some unofficial tinctures, ether, spirit of ether, ammoniated alcohol, and spirit of nitrous ether are used. The use of alcohol as a solvent for the active or useful principles in drugs has been practised for many years, but it has required a long time and much experience to determine the proper proportion of water to dilute the alcohol so that the menstrua should thoroughly exhaust the drugs without extracting the inert principles, and yet contain sufficient alcohol to secure permanent preparations that will not deposit in time a portion of their active constituents. The advantages of alcohol as a menstruum have been proved so thoroughly, that the use of aqueous preparations has greatly declined in this country; and yet there are some instances, particularly in the case of the weak tinctures and those requiring a large dose, in which the therapeutic action of the menstruum almost equals that of the drug. In these cases, however, the physician may prefer the fluid extract when he does not desire the stimulating action of the alcohol in the tincture.

In selecting the menstrua the proportion of water in each case was made as great as possible without endangering the permanency of the preparation, one especial advantage being that such tinctures may be added in small proportions to aqueous preparations without serious precipitation. In this respect tinctures have usually a great advantage over fluid extracts, and weaker alcoholic menstrua are often used successfully for tinctures when such would be entirely unsuitable for fluid extracts, because the tincture, on account of its comparative weakness, having a much larger proportion of menstruum to exhaust the drug with, than the fluid extract, may have the excess over the proportion of alcohol used in the fluid extract made up with water. It has been proved that a pint of diluted alcohol will extract by percolation a larger proportion of the soluble principles of a drug than half a pint of alcohol and half a pint of water percolated separately through the drug.

[1] Tincture of Iodine.

The properties of *alcohol* are considered under another head (Part IV.), yet it seems desirable to notice here the solvent properties of this valuable preservative. It mixes freely with water, ether, acetic acid, a number of volatile oils, and castor oil; it dissolves resins, camphor, tannin, benzoic acid, chlorophyl, the alkaloids, balsams, iodine, ferric chloride, ammonium carbonate, etc. *Diluted alcohol* extracts from drugs, gum, extractive, chlorophyl, albumen, coloring matter, resins, volatile oils, alkaloids, sugar, tannin, etc. *Glycerin* is used in tinctures to prevent precipitation by retaining in solution principles which would otherwise in time be deposited.

Preparation.—Tinctures are officially made in three ways: 1. By percolation. 2. By maceration. 3. By solution or dilution.

1. **By Percolation.**—This is the best method for making tinctures, and it is always directed by the Pharmacopœia when practicable. Tinctures are made in this way from all drugs which are capable of being readily comminuted and displaced. The special advantages of percolation over maceration and expression are seen in the saving of time and labor, and in the greater efficiency of the product if the process has been carefully and skilfully performed. The introduction of metric measures into the U. S. Pharmacopœia of 1890 has greatly simplified the working formulas, there being now no calculations necessary to determine the end-product; the employment of metric receiving-bottles in percolating operations secures accuracy within reasonable limits, and their convenience will always be a recommendation. The use of parts by weight for tinctures proved unsatisfactory. If the drugs from which the tinctures are directed to be made could be standardized so that they would always contain a definite and uniform weight of the active principles, there might be an advantage in bringing the end-product to a weight which would bear a simple relation to the proportion of active principles selected as a standard; but the Pharmacopœia, for obvious reasons, has not fixed a limit for even the amount of moisture in air-dried drugs, and to assay all of them and fix a maximum and minimum limit of each active principle present in each drug would be impracticable, and in most cases impossible. Now, the variation in the amount of moisture and in the proportion of active principles in commercial drugs is far greater than is generally supposed; and so long as this ever-present bar to uniformity is not overcome, it is useless to regard the trifling advantage supposed to exist in favor of accuracy and convenience in weighing liquids: practically, the question of accuracy resolves itself into one of personal error, for a careful operator will make more accurate tinctures by using measures than a careless one will by using weights, and *vice versa.* Fifty-seven official tinctures, or more than two-thirds of the whole number, are made by percolation.

2. **By Maceration.**—This method of making tinctures is officially used in the case of resins, balsams, gums, soap, etc., where the practical difficulties likely to be encountered in percolation would offset any advantages that the latter process might possess (see page 253).

3. **By Solution or Dilution.**—A few tinctures are made in this way, such as tincture of iodine by dissolving iodine in alcohol, tincture of ferric chloride by diluting the solution of ferric chloride with alcohol.

The following tables exhibit the official tinctures, classified so as to show their relative strength both as to weight and volume, the variations in menstrua, and other useful data:

Table of Official Tinctures arranged in the Order of their Relative Strength, with Other Data.

Number of Grammes of Active Agent or Drug in 100 C.c.	Total Number of Grains of Active Ingredients in a Fluidrachm.	Official Name.	Fineness of Powder.	Menstruum.	Ingredients in 1000 C.c.
1.6	0.91	Tinctura Opii Camphorata.	. .	Dil. Alcohol 96; Glycerin 4.	4 Gm. Powd. Opium; 4 Gm. Benzoic Acid; 4 Gm. Camphor; 4 C.c. Oil of Anise.
Ext. 2	1.14	Nucis Vomicæ.	. .	Alc. 75; Wat. 25.	20 Gm. Dried Extract.
4.5	2.56	Lavandulæ Composita.	. .	Alc. 70; Wat. 25; Dil. Alc. to make 100.	8 C.c. Oil of Lavender Flowers; 2 C.c. Oil of Rosemary; 20 Gm. Cassia Cinnamon; 5 Gm. Cloves; 10 Gm. Nutmeg; 10 Gm. Red Saunders.
5	2.85	Cantharidis.	60	Alcohol.	50 Gm. Cantharides.
5	2.85	Capsici.	30	Alc. 95; Wat. 5.	50 Gm. Capsicum.
5	2.85	Moschi.	. .	Alc. 50; Wat. 50.	50 Gm. Musk.
5	2.85	Strophanthi.	30	Alc. 65; Wat. 35.	50 Gm. Strophanthus.
5.5	3.13	Cardamomi Composita.	40	Dil. Alcohol 95; Glycerin 5.	20 Gm. Cardamom; 20 Gm. Cassia Cinnamon; 10 Gm. Caraway; 5 Gm. Cochineal.
7	3.99	Iodi.	. .	Alcohol.	70 Gm. Iodine.
9.4	5.36	Ferri Chloridi.	. .	Alc. 75; Wat. 25.	250 C.c. Solution of Ferric Chloride.
10	5.70	Arnicæ Radicis.	40	Alc. 65; Wat. 35.	100 Gm. Arnica Root.
10	5.70	Bryoniæ.	40	Alcohol.	100 Gm. Bryonia.
10	5.70	Calumbæ.	20	Alc. 60; Wat. 40.	100 Gm. Calumba.
10	5.70	Cardamomi.	30	Dil. Alcohol.	100 Gm. Cardamom.
10	5.70	Chiratæ.	40	Alc. 65; Wat. 35.	100 Gm. Chirata.
10	5.70	Cinnamomi.	40	Alc. 75; Wat. 20; Glycerin 5.	100 Gm. Ceylon Cinnamon.
10	5.70	Croci.	. .	Dil. Alcohol.	100 Gm. Saffron.
10	5.70	Kino.	. .	Alc. 65; Wat. 20; Glycerin 15.	100 Gm. Kino.
10	5.70	Matico.	40	Dil. Alcohol.	100 Gm. Matico.
10	5.70	Opii.	80	Alc. 50; Wat. 50.	100 Gm. Powd. Opium.
10	5.70	Opii Deodorati.	80	Alc. 20; Wat. 80.	100 Gm. Powd. Opium.
10	5.70	Quassiæ.	40	Alc. 35; Wat. 65.	100 Gm. Quassia.
10	5.70	Serpentariæ.	40	Alc. 65; Wat. 35.	100 Gm. Serpentaria.
10	5.70	Sumbul.	30	Alc. 65; Wat. 35.	100 Gm. Sumbul.
10	5.70	Tolutana.	. .	Alcohol.	100 Gm. Balsam of Tolu.
10	5.70	Vanillæ.	Cut and bruised.	Alc. 65; Wat. 35.	100 Gm. Vanilla; 200 Gm. Sugar.
12	6.84	Rhei.	40	Alc. 60; Wat. 30; Glycerin 10.	100 Gm. Rhubarb; 20 Gm. Cardamom.
15	8.56	Belladonnæ Foliorum.	60	Dil. Alcohol.	150 Gm. Belladonna Leaves.
15	8.56	Cannabis Indicæ.	40	Alcohol.	150 Gm. Indian Cannabis.

Table of Tinctures, U. S. P.—(*Continued.*)

Number of Grammes of Active Agent or Drug in 100 C.c.	Total Number of Grains of Active Ingredients in a Fluidrachm.	Official Name.	Fineness of Powder.	Menstruum.	Ingredients in 1000 C.c.
15	8.56	Tinctura Catechu Composita.	40	Dil. Alcohol.	100 Gm. Catechu; 50 Gm. Cassia Cinnamon.
15	8.56	Colchici Seminis.	30	Alc. 60; Wat. 40.	150 Gm. Colchicum Seed.
15	8.56	Digitalis.	60	Dil. Alcohol.	150 Gm. Digitalis.
15	8.56	Gelsemii.	60	Alc. 65; Wat. 35.	150 Gm. Gelsemium.
15	8.56	Gentianæ Composita.	40	Alc. 60; Wat. 40.	100 Gm. Gentian; 40 Gm. Bitter Orange Peel; 10 Gm. Cardamom.
15	8.56	Hyoscyami.	60	Dil. Alcohol.	150 Gm. Hyoscyamus.
15	8.56	Physostigmatis.	40	Alcohol.	150 Gm. Physostigma.
15	8.56	Sanguinariæ.	60	Alc. 60; Wat. 40; Acetic Acid 2.	150 Gm. Sanguinaria.
15	8.56	Scillæ.	30	Alc. 75; Wat. 25.	150 Gm. Squill.
15	8.56	Stramonii Seminis.	40	Dil. Alcohol.	150 Gm. Stramonium Seed.
19	10.84	Rhei Dulcis.	40	Alc. 50; Wat. 40; Glycerin 10.	100 Gm. Rhubarb; 40 Gm. Glycyrrhiza; 40 Gm. Anise; 10 Gm. Cardamom.
20	11.40	Arnicæ Florum.	20	Dil. Alcohol.	200 Gm. Arnica Flowers.
20	11.40	Asafœtidæ.	Bruised.	Alcohol.	200 Gm. Asafetida.
20	11.40	Aurantii Amari.	30	Alc. 60; Wat. 40.	200 Gm. Bitter Orange Peel.
20	11.40	Aurantii Dulcis.	Cut.	Alcohol.	200 Gm. Sweet Orange Peel.
20	11.40	Benzoini.	40	Alcohol.	200 Gm. Benzoin.
20	11.40	Calendulæ.	20	Alcohol.	200 Gm. Calendula.
20	11.40	Cimicifugæ.	60	Alcohol.	200 Gm. Cimicifuga.
20	11.40	Cinchonæ.	60	Alc. 67.5; Wat. 25; Glyc. 7.5.	200 Gm. Cinchona.
20	11.40	Cinchonæ Composita.	60	Alc. 85; Wat. 7.5; Glyc. 7.5.	100 Gm. Red Cinchona; 80 Gm. Bitter Orange Peel; 20 Gm. Serpentaria.
20	11.40	Cubebæ.	30	Alcohol.	200 Gm. Cubeb.
20	11.40	Gallæ.	40	Alc. 90; Glyc. 10.	200 Gm. Nutgall.
20	11.40	Guaiaci.	20	Alcohol.	200 Gm. Guaiac.
20	11.40	Guaiaci Ammoniata.	20	Aromatic Spirit of Ammonia.	200 Gm. Guaiac.
20	11.40	Humuli.	20	Dil. Alcohol.	200 Gm. Hops.
20	11.40	Hydrastis.	60	Dil. Alcohol.	200 Gm. Hydrastis.
20	11.4	Ipecacuanhæ et Opii.	. .	Dil. Alcohol.	1000 C.c. Deodorized Tincture of Opium; 100 C.c. Fluid Extract of Ipecac.
20	11.40	Krameriæ.	40	Dil. Alcohol.	200 Gm. Krameria.
20	11.40	Lobeliæ.	40	Dil. Alcohol.	200 Gm. Lobelia.
20	11.40	Myrrhæ.	40	Alcohol.	200 Gm. Myrrh.
20	11.40	Pyrethri.	40	Alcohol.	200 Gm. Pyrethrum.
20	11.40	Quillajæ.	Coarsely ground.	Alc. 35; Wat. 65.	200 Gm. Quillaja.
20	11.40	Valerianæ.	60	Alc. 75; Wat. 25.	200 Gm. Valerian.

Table of Tinctures, U. S. P.—(*Continued.*)

Number of Grammes of Active Agent or Drug in 100 C.c.	Total Number of Grains of Active Ingredients in a Fluidrachm.	Official Name.	Fineness of Powder.	Menstruum.	Ingredients in 1000 C.c.
20	11.40	Tinctura Valerianæ Ammoniata.	60	Aromatic Spirit of Ammonia.	200 Gm. Valerian.
20	11.40	Zingiberis.	40	Alcohol.	200 Gm. Ginger.
26	14.82	Benzoini Composita.	20	Alcohol.	120 Gm. Benzoin; 20 Gm. Purified Aloes; 80 Gm. Storax; 40 Gm. Balsam of Tolu.
30	17.11	Aloes.	50	Dil. Alcohol.	100 Gm. Purified Aloes; 200 Gm. Liquorice Root.
30	17.11	Aloes et Myrrhæ.	40	Alc. 75; Wat. 25.	100 Gm. Purified Aloes; 100 Gm. Myrrh; 100 Gm. Liquorice Root.
30	17.11	Rhei Aromatica.	40	Alc. 50; Wat. 40; Glyc. 10.	200 Gm. Rhubarb; 40 Gm. Cassia Cinnamon; 40 Gm. Cloves; 20 Gm. Nutmeg.
35	19.96	Aconiti.	60	Alc. 70; Wat. 30.	350 Gm. Aconite.
40	22.81	Veratri Viridis.	60	Alcohol.	400 Gm. Veratrum Viride.
50	28.52	Tincturæ Herbarum Recentium.	Bruised or crushed.	Alcohol.	500 Gm. Fresh Herb.
50	28.52	Tinctura Lactucarii.	20	Alcohol, Water, and Glycerin.	500 Gm. Lactucarium.

PRACTICAL PROCESSES FOR OFFICIAL TINCTURES.

TINCTURA ACONITI. *U. S.* Tincture of Aconite.

	Metric.	Old form.
Aconite, in No. 60 powder	350 Gm.	11 oz. av. 300 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 700 C.c. [old form 22½ fl. oz.] of Alcohol to 300 C.c. [old form 9½ fl. oz.] of Water. Having moistened the powder with 200 C.c. [old form 6½ fl. oz.] of menstruum, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ALOES. *U. S.* Tincture of Aloes.

	Metric.	Old form.
Purified Aloes, in moderately fine powder . .	100 Gm.	3 oz. av. 148 gr.
Liquorice Root, in No. 40 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the powders, and, having moistened the mixture with 80 C.c. [old form 2½ fl. oz.] of Diluted Alcohol, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ALOES ET MYRRHÆ. *U. S.* **Tincture of Aloes and Myrrh.**

	Metric.	Old form.
Purified Aloes	100 Gm.	3 oz. av. 148 gr.
Myrrh	100 Gm.	3 oz. av. 148 gr.
Liquorice Root, in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 750 C.c. [old form 24 fl. oz.] of Alcohol to 250 C.c. [old form 8 fl. oz.] of Water. Having mixed the Aloes, Myrrh, and Liquorice Root, reduce them to a moderately coarse No. 40 powder. Moisten the powder with 60 C.c. [old form 2 fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ARNICÆ FLORUM. *U. S.* **Tincture of Arnica Flowers.**

	Metric.	Old form.
Arnica Flowers, in No. 20 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Pack the powder firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ARNICÆ RADICIS. *U. S.* **Tincture of Arnica Root.**

	Metric.	Old form.
Arnica Root, in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Moisten the powder with 150 C.c. [old form 5 fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ASAFŒTIDÆ. *U. S.* **Tincture of Asafetida.**

	Metric.	Old form.
Asafetida, bruised	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Asafetida with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA AURANTII AMARI. U. S. Tincture of Bitter Orange Peel.

	Metric.	Old form.
Bitter Orange Peel, in No. 30 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 600 C.c. [old form 19 fl. oz.] of Alcohol to 400 C.c. [old form 13 fl. oz.] of Water. Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA AURANTII DULCIS. U. S. Tincture of Sweet Orange Peel.

	Metric.	Old form.
Sweet Orange Peel, taken from the fresh fruit .	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Orange Peel (which should be as free as possible from the inner, white layer), previously cut into small pieces, with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it moderately in a conical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA BELLADONNÆ FOLIORUM. U. S. Tincture of Belladonna Leaves.

[TINCTURA BELLADONNÆ, PHARM. 1880.]

	Metric.	Old form.
Belladonna Leaves, in No. 60 powder	150 Gm.	5 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA BENZOINI. U. S. Tincture of Benzoin.

	Metric.	Old form.
Benzoin, in moderately coarse powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the powder with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and macerate for seven days, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA BENZOINI COMPOSITA. *U.S.* **Compound Tincture of Benzoin.**

	Metric.	Old form.
Benzoin, in coarse powder	120 Gm.	4 oz. av.
Purified Aloes, in coarse powder	20 Gm.	292 grains.
Storax	80 Gm.	2 oz. av. 292 gr.
Balsam of Tolu	40 Gm.	1 oz. av. 146 gr
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Benzoin, Aloes, Storax, and Balsam of Tolu with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and digest the mixture, at a temperature not exceeding 65° C. (149° F.), for two hours, in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture, when cold, measure 1000 C.c. [old form 2 pints].

TINCTURA BRYONIÆ. *U.S.* **Tincture of Bryonia.**

	Metric.	Old form.
Bryonia, recently dried, and in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CALENDULÆ. *U.S.* **Tincture of Calendula.**

	Metric.	Old form.
Calendula, in No. 20 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CALUMBÆ. *U.S.* **Tincture of Calumba.**

	Metric.	Old form.
Calumba, in No. 20 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 600 C.c. [old form 19 fl. oz.] of Alcohol to 400 C.c. [old form 13 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CANNABIS INDICÆ. *U. S.* Tincture of Indian Cannabis.

	Metric.	Old form.
Indian Cannabis, in No. 40 powder	150 Gm.	5 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CANTHARIDIS. *U. S.* Tincture of Cantharides.

	Metric.	Old form.
Cantharides, in No. 60 powder	50 Gm.	780 grains.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 30 C.c. [old form 1 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CAPSICI. *U. S.* Tincture of Capsicum.

	Metric.	Old form.
Capsicum, in No. 80 powder	50 Gm.	780 grains.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 950 C.c. [old form 30 fl. oz.] of Alcohol to 50 C.c. [old form 2 fl. oz.] of Water. Having moistened the powder with 40 C.c. [old form 1¼ fl. oz.] of the menstruum, pack it firmly in a cylindrical percolator; then gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CARDAMOMI. *U. S.* Tincture of Cardamom.

	Metric.	Old form.
Cardamom, in No. 80 powder	100 Gm.	3 oz. av. 148 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in

a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CARDAMOMI COMPOSITA. *U. S.* **Compound Tincture of Cardamom.**

	Metric.	Old form.
Cardamom	20 Gm.	292 grains.
Cassia Cinnamon	20 Gm.	292 grains.
Caraway	10 Gm.	146 grains.
Cochineal	5 Gm.	73 grains.
Glycerin	50 C.c.	1¼ fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Cardamom, Cinnamon, Caraway, and Cochineal, and reduce them to a moderately coarse (No. 40) powder. Having moistened the powder with 25 C.c. [old form 384 min.] of Diluted Alcohol, pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 950 C.c. [old form 30½ fl. oz.] of Tincture are obtained; then add the Glycerin, and mix them.

TINCTURA CATECHU COMPOSITA. *U. S.* **Compound Tincture of Catechu.**

	Metric.	Old form.
Catechu, in No. 40 powder	100 Gm.	8 oz. av. 148 gr.
Cassia Cinnamon, in No. 40 powder	50 Gm.	1 oz. av. 298 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the powders, and, without moistening, pack the mixture firmly in a cylindrical percolator; then gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CHIRATÆ. *U. S.* **Tincture of Chirata.**

	Metric.	Old form.
Chirata, in No. 40 powder	100 Gm.	8 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CIMICIFUGÆ. *U. S.* **Tincture of Cimicifuga.**

	Metric.	Old form.
Cimicifuga, in No. 60 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CINCHONÆ. *U. S.* Tincture of Cinchona.

	Metric.	Old form.
Cinchona, in No. 60 powder	200 Gm.	6 oz. av. 296 gr.
Glycerin	75 C.c.	2½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Glycerin with 675 C.c. [old form 21½ fl. oz.] of Alcohol and 250 C.c. [old form 8 fl. oz.] of Water. Having moistened the powder with 200 C.c. [old form 6½ fl. oz.] of the menstruum, macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, and pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of Alcohol and Water, made in the same proportions as before, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CINCHONÆ COMPOSITA. *U. S.* Compound Tincture of Cinchona.

	Metric.	Old form.
Red Cinchona	100 Gm.	3 oz. av. 148 gr.
Bitter Orange Peel	80 Gm.	2 oz. av. 293 gr.
Serpentaria	20 Gm.	292 grains.
Glycerin	75 C.c.	2½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Glycerin with 850 C.c. [old form 27 fl. oz.] of Alcohol and 75 C.c. [old form 2½ fl. oz.] of Water. Having mixed the Cinchona, Orange Peel, and Serpentaria, reduce them to a fine (No. 60) powder. Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of Alcohol and Water, made in the same proportions as before, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CINNAMOMI. *U. S.* Tincture of Cinnamon.

	Metric.	Old form.
Ceylon Cinnamon, in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Glycerin	50 C.c.	1½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Glycerin with 750 C.c. [old form 24 fl. oz.] of Alcohol and 200 C.c. [old form 6½ fl. oz.] of Water. Having moistened the powder with 50 C.c. [old form 1½ fl. oz.] of the menstruum, pack it in a conical percolator, gradually pour on more of a mixture of Alcohol and Water, made in the same proportions as before, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA COLCHICI SEMINIS. *U.S.* Tincture of Colchicum Seed.

[TINCTURA COLCHICI, PHARM. 1880]

	Metric.	Old form.
Colchicum Seed, in No. 80 powder	150 Gm.	5 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 600 C.c. [old form 19 fl. oz.] of Alcohol and 400 C.c. [old form 13 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, macerate for twenty-four hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CROCI. *U.S.* Tincture of Saffron.

	Metric.	Old form.
Saffron	100 Gm.	3 oz. av. 148 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the Saffron with 100 C.c. [old form 3¼ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA CUBEBÆ. *U.S.* Tincture of Cubeb.

	Metric.	Old form.
Cubeb, in No. 30 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA DIGITALIS. *U.S.* Tincture of Digitalis.

	Metric.	Old form.
Digitalis, in No. 60 powder	150 Gm.	5 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURÆ HERBARUM RECENTIUM. *U.S.* Tinctures of Fresh Herbs.

These Tinctures, when not otherwise directed, are to be prepared by the following formula:

Take of	Metric.	Old form.
The Fresh Herb, bruised or crushed	500 Gm.	17 oz. av.
Alcohol	1000 C.c.	2 pints.

Macerate the Herb with the Alcohol for fourteen days; then express the liquid and filter.

TINCTURA FERRI CHLORIDI. *U.S.* Tincture of Ferric Chloride.

A hydro-alcoholic solution of Ferric Chloride [$Fe_2Cl_6 = 323.98$] containing about 13.6 per cent. of the anhydrous salt, and corresponding to about 4.7 (4.69) per cent. of metallic iron.

	Metric.	Old form.
Solution of Ferric Chloride	250 C.c.	8 fl. oz.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Solution with enough Alcohol to make 1000 C.c. [old form 2 pints]. Let the Tincture stand, in a closely-covered vessel, at least three months; then transfer it to glass-stoppered bottles, and keep it protected from light.

A bright, brownish liquid, having a slightly ethereal odor, a very astringent, styptic taste, and an acid reaction.

Specific gravity: about 0.960 at 15° C. (59° F.).

The Tincture yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T. S., and a white one, insoluble in nitric acid, with silver nitrate T. S.

After the Tincture has been exposed for some time to daylight, it yields a greenish or greenish-blue color with potassium ferricyanide T. S., showing the presence of some ferrous salt, due to reduction.

If the iron be completely precipitated from a portion of the Tincture by an excess of ammonia water, the filtrate should be colorless, and should not yield a white or dark-colored precipitate with hydrogen sulphide T. S. (absence of *zinc* or *copper*), nor should it leave a fixed residue on evaporation and gentle ignition (absence of *salts of the fixed alkalies.*)

On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute portion of the Tincture, the crystal should not become colored brown, nor should there be a brownish-black zone developed around it (absence of *nitric acid*).

On diluting 1 C.c. of the Tincture with water to 12 C.c., and boiling, the liquid should remain clear (absence of *oxychloride*).

If 1.12 (1.1176) Gm. of the Tincture be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T. S., it should require about 9.4 C.c. of decinormal sodium hyposulphite V. S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).

TINCTURA GALLÆ. *U. S.* Tincture of Nutgall.

	Metric.	Old form.
Nutgall, in No. 40 powder	200 Gm.	6 oz. av. 296 gr.
Glycerin	100 C.c.	3¼ fl. oz.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Glycerin with 900 C.c. [old form 28¾ fl. oz.] of Alcohol. Pack the powder, without moistening it, in a conical glass percolator; then gradually pour upon it the menstruum, and, afterwards, Alcohol, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA GELSEMII. *U. S.* Tincture of Gelsemium.

	Metric.	Old form.
Gelsemium, in No. 60 powder	150 Gm.	5 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA GENTIANÆ COMPOSITA. *U. S.* Compound Tincture of Gentian.

	Metric.	Old form.
Gentian	100 Gm.	3 oz. av. 148 gr.
Bitter Orange Peel	40 Gm.	1 oz. av. 147 gr.
Cardamom	10 Gm.	146 grains.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Gentian, Orange Peel, and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix Alcohol and Water in the proportion of 600 C.c. [old form 19 fl. oz.] of Alcohol to 400 C.c. [old form 13 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3¼ fl. oz.] of menstruum, macerate for twenty-four hours; then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA GUAIACI. *U. S.* Tincture of Guaiac.

	Metric.	Old form.
Guaiac, in coarse powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints

Mix the powder with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and macerate for seven days, in a closed vessel; then filter through

paper, adding, through the filter, enough Alcohol to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA GUAIACI AMMONIATA. *U.S.* **Ammoniated Tincture of Guaiac.**

	Metric.	Old form.
Guaiac, in coarse powder	200 Gm.	6 oz. av. 296 gr.
Aromatic Spirit of Ammonia, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the powder with 800 C.c. [old form 25½ fl. oz.] of Aromatic Spirit of Ammonia, and macerate for seven days, in a closed vessel; then filter through paper, in a well-covered funnel, and add, through the filter, Aromatic Spirit of Ammonia, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA HUMULI. *U.S.* **Tincture of Hops.**

	Metric.	Old form.
Hops, well dried and in No. 20 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 400 C.c. [old form 13 fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA HYDRASTIS. *U.S.* **Tincture of Hydrastis.**

	Metric.	Old form.
Hydrastis, in No. 60 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA HYOSCYAMI. *U.S.* **Tincture of Hyoscyamus.**

	Metric.	Old form.
Hyoscyamus, in No. 60 powder	150 Gm.	5 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA IODI. *U.S.* **Tincture of Iodine.**

	Metric.	Old form.
Iodine	70 Gm.	255 grains.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	½ pint.

Triturate the Iodine rapidly, in a mortar, to a coarse powder, and transfer it at once to a graduated bottle. Rinse the mortar with several successive portions of Alcohol, and pour the rinsings into the bottle. Then add Alcohol, shaking the bottle occasionally, until the Iodine is dissolved, and the finished Tincture measures 1000 C.c. [old form ½ pint]. (If there is no necessity for rapid solution, the unpowdered iodine may be placed in the bottle containing the Alcohol and allowed to dissolve slowly.)

If 6.3 C.c. of the Tincture be mixed with a solution of 2 Gm. of potassium iodide in 25 C.c. of water, and a little starch T. S. added, it should require, for complete decoloration, about 35 C.c. of decinormal sodium hyposulphite V. S. (corresponding to about 7 Gm. of iodine in 100 C.c.).

TINCTURA IPECACUANHÆ ET OPII. *U. S.* Tincture of Ipecac and Opium.

	Metric.	Old form.
Deodorized Tincture of Opium	1000 C.c.	10 fl. oz.
Fluid Extract of Ipecac	100 C.c.	1 fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	10 fl. oz.

Evaporate the Deodorized Tincture of Opium, in a tared capsule, on a water-bath, until it weighs 800 Gm. [old form 8 oz. av.]. When it has become cold, add to it the Fluid Extract of Ipecac, filter the mixture, and pass enough Diluted Alcohol through the filter to make the Tincture measure 1000 C.c. [old form 10 fl. oz.].

TINCTURA KINO. *U. S.* Tincture of Kino.

	Metric.	Old form.
Kino	100 Gm.	365 grains.
Glycerin	150 C.c.	1 fl. oz. 96 min.
Water	200 C.c.	1 fl. oz. 288 min.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	½ pint.

Mix the Glycerin with the Water and 650 C.c. [old form 5 fl. oz.] of Alcohol. Rub the Kino, in a mortar, adding gradually a sufficient quantity of the menstruum, until a smooth paste is produced. Transfer this to a bottle, add the remainder of the menstruum, and macerate for twenty-four hours, with occasional agitation. Then filter through paper, adding, through the filter, enough Alcohol to make the product measure 1000 C.c. [old form ½ pint]. Keep the Tincture in small, completely-filled and well-stoppered bottles, in a cool place.

TINCTURA KRAMERIÆ. *U. S.* Tincture of Krameria.

	Metric.	Old form.
Krameria, in No. 40 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in

a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA LACTUCARII. *U. S.* **Tincture of Lactucarium.**

	Metric.	Old form.
Lactucarium	500 Gm.	16 oz. av. 302 gr.
Glycerin	250 C.c.	8 fl. oz.
Water,		
Alcohol,		
Benzin,		
Diluted Alcohol, each, a sufficient quantity.		

Beat the Lactucarium in an iron mortar, with clean sand, to a coarse powder, and introduce it into a bottle; add 2000 C.c. [old form 4 pints] of Benzin, cork the bottle tightly, and set it aside for forty-eight hours, frequently agitating the mixture. Pour the mixture on a double filter, and allow it to drain. Wash the residue by gradually adding 1500 C.c. [old form 40 fl. oz.] of Benzin. Allow the Lactucarium to dry by exposing it to a current of air. When it is dry, and free from the odor of Benzin, reduce it to powder, using more sand, if necessary, and pack it moderately in a conical percolator. Mix the Glycerin with 200 C.c. [old form 6½ fl. oz.] of Water, and 500 C.c. [old form 8 fl. oz.] of Alcohol, and moisten the powder with 500 C.c. [old form 8 fl. oz.] of the mixture. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed very slowly, gradually adding, first, the remainder of the menstruum, and then Diluted Alcohol, until the Lactucarium is exhausted. Reserve the first 750 C.c. [old form 24 fl. oz.] of the percolate, evaporate the remainder on a water-bath, at a temperature not exceeding 70° C. (158° F.), to 250 C.c. [old form 8 fl. oz.], and mix this with the reserved portion. Filter, and add enough Diluted Alcohol through the filter to make the product measure 1000 C.c. [old form 2 pints].

TINCTURA LAVANDULÆ COMPOSITA. *U. S.* **Compound Tincture of Lavender.**

[COMPOUND SPIRIT OF LAVENDER.]

	Metric.	Old form.
Oil of Lavender Flowers	8 C.c.	122 minims.
Oil of Rosemary	2 C.c.	31 minims.
Cassia Cinnamon, in coarse powder	20 Gm.	292 grains.
Cloves	5 Gm.	73 grains.
Nutmeg	10 Gm.	146 grains.
Red Saunders, in coarse powder	10 Gm.	146 grains.
Alcohol	700 C.c.	22½ fl. oz.
Water	250 C.c.	8 fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Oils in the Alcohol, and add the Water. Crush the Nutmeg in a mortar, mix it with the Cinnamon, Cloves, and Red

Saunders, and reduce the mixture, by grinding, to a coarse (No. 20) powder. Moisten the mixture with a sufficient quantity of the alcoholic solution of the Oils, pack it firmly in a cylindrical percolator, gradually pour upon it the remainder of the alcoholic solution, and, afterwards, Diluted Alcohol, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA LOBELIÆ. *U. S.* Tincture of Lobelia.

	Metric.	Old form.
Lobelia, in No. 40 powder	200 Gm.	6 oz. av. 296 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA MATICO. *U. S.* Tincture of Matico.

	Metric.	Old form.
Matico, in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the Matico with 100 C.c. [old form 3¼ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA MOSCHI. *U. S.* Tincture of Musk.

	Metric.	Old form.
Musk	50 Gm.	365 grains.
Alcohol	450 C.c.	7¼ fl. oz.
Water	450 C.c.	7¼ fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Rub the Musk in a mortar, first, with a little of the Water, until a smooth mixture is made, and then with the remainder of the Water. Transfer the whole to a bottle, add the Alcohol, and macerate the mixture for seven days, occasionally shaking the bottle. Then filter through paper, adding, through the filter, enough Diluted Alcohol to make the Tincture measure 1000 C.c. [old form 1 pint].

TINCTURA MYRRHÆ. *U. S.* Tincture of Myrrh.

	Metric.	Old form.
Myrrh, in moderately coarse powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the powder with 800 C.c. [old form 25½ fl. oz.] of Alcohol, and macerate for seven days in a closed vessel; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA NUCIS VOMICÆ. *U. S.* Tincture of Nux Vomica.

	Metric.	Old form.
Extract of Nux Vomica, dried at 100° C. (212° F.) .	20 Gm.	292 grains.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Extract of Nux Vomica (which should contain 15 per cent. of alkaloids) in a sufficient quantity of a mixture of 3 volumes of Alcohol and 1 volume of Water, to make the Tincture measure 1000 C.c. [old form 2 pints].

If 100 C.c. of Tincture of Nux Vomica be evaporated to dryness, and the residue tested by the process of assay given under *Extractum Nucis Vomicæ*, it should be found to contain 0.3 Gm. of alkaloids.

TINCTURA OPII. *U. S.* Tincture of Opium.

[Laudanum.]

	Metric.	Old form.
Powdered Opium	100 Gm.	3 oz. av. 148 gr.
Precipitated Calcium Phosphate	50 Gm.	1 oz. av. 300 gr.
Water	400 C.c.	13 fl. oz.
Alcohol	400 C.c.	13 fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Rub the powders in a mortar, with the Water previously heated to the temperature of 90° C. (194° F.), until a smooth mixture is made, and macerate for twelve hours; then add the Alcohol, mix thoroughly, and transfer the whole to a cylindrical percolator. Return to the percolator the first portion of the percolate, until it runs through clear, and, when the liquid ceases to drop, gradually pour on Diluted Alcohol, continuing the percolation slowly, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

If 100 C.c. of Tincture of Opium be assayed by the process immediately following, it should yield from 1.3 to 1.5 Gm. of crystallized morphine.

Assay of Tincture of Opium.

Tincture of Opium, *one hundred cubic centimeters*	100 C.c.
Ammonia Water, *three and five-tenths cubic centimeters*	3.5 C.c.
Alcohol,	
Ether,	
Water, each, a sufficient quantity.	

Evaporate the Tincture to about 20 C.c., add 40 C.c. of water, mix thoroughly, and set the liquid aside for an hour, occasionally stirring, and disintegrating the resinous flakes adhering to the capsule. Then filter, and wash the filter and residue with water, until all soluble matters are extracted, collecting the washings separately.

Evaporate in a tared capsule, first, the washings to a small volume, then add the first filtrate, and evaporate the whole to a weight of 14 Gm. Rotate the concentrated solution about in the capsule until the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 C.c., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 20 Gm. Then add 10 Gm. (or 12.2 C.c.) of alcohol, shake well, add 25 C.c. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during ten minutes, and then set it aside, in a moderately cool place, for at least six hours, or over night.

Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel two rapidly-acting filters, of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 C.c. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 C.c. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 C.c. in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother-water, and afterwards wash them, drop by drop, from a pipette, with alcohol previously saturated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 C.c., or more if necessary. Allow the filter to dry in a moderately warm place, at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass and weigh them.

The weight found represents the amount of crystallized morphine obtained from 100 C.c. of the Tincture.

TINCTURA OPII CAMPHORATA. *U. S.* Camphorated Tincture of Opium.

[PAREGORIC.]

	Metric.	Old form.
Powdered Opium	4 Gm.	58½ grains.
Benzoic Acid	4 Gm.	58½ grains.
Camphor	4 Gm.	58½ grains.
Oil of Anise	4 C.c.	1 fl. dr.
Glycerin	40 C.c.	1¼ fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Add 900 C.c. [old form 29 fl. oz.] of Diluted Alcohol to the other ingredients, contained in a suitable vessel, and macerate for three days, shaking frequently; then filter through paper, in a well-covered funnel, and pass enough Diluted Alcohol through the filter to make the product measure 1000 C.c. [old form 2 pints].

TINCTURA OPII DEODORATI. *U. S.* Tincture of Deodorized Opium.

[TINCTURA OPII DEODORATA, PHARM. 1880.]

	Metric.	Old form.
Powdered Opium	100 Gm.	3 oz. av. 148 gr.
Precipitated Calcium Phosphate	50 Gm.	1 oz. av. 300 gr.
Ether	200 C.c.	6½ fl. oz.
Alcohol	200 C.c.	6½ fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Rub the powders in a mortar with 400 C.c. [old form 13 fl. oz.] of Water previously heated to the temperature of 90° C. (194° F.), until a smooth mixture is made, and macerate for twelve hours; then pour the mixture on a filter, or transfer it to a cylindrical percolator, and gradually pour on Water, until the Opium is practically exhausted. Reduce the percolate, by evaporation on a water-bath, to 100 C.c. [old form 3½ fl. oz.], and, when it has cooled, shake it repeatedly with the Ether in a bottle. When the ethereal solution has separated by standing, pour it off, and evaporate the remaining liquid until all traces of Ether have disappeared. Mix the residue with 500 C.c. [old form 16 fl. oz.] of Water, and filter the mixture through paper. When the liquid has ceased to pass, add enough Water, through the filter, to make the filtered liquid measure 800 C.c. [old form 25½ fl. oz.]. Lastly, add the Alcohol, and mix them.

If 100 C.c. of Tincture of Deodorized Opium be assayed by the process given under *Tinctura Opii*, it should yield from 1.3 to 1.5 Gm. of crystallized morphine.

TINCTURA PHYSOSTIGMATIS. *U. S.* Tincture of Physostigma.

	Metric.	Old form.
Physostigma, in No. 40 powder	150 Gm.	5 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 100 C.c. [old form 3½ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA PYRETHRI. *U. S.* Tincture of Pyrethrum.

	Metric.	Old form.
Pyrethrum, in No. 40 powder	200 Gm.	6 oz. av. 296 grains.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA QUASSIÆ. *U. S.* Tincture of Quassia.

	Metric.	Old form.
Quassia, in No. 40 powder	100 Gm.	3 oz. av. 148 grains.
Alcohol,		
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 350 C.c. [old form 11 fl. oz.] of Alcohol to 650 C.c. [old form 21 fl. oz.] of Water. Having moistened the powder with 100 C.c. [old form 3½ fl. oz.] of

the menstruum, macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA QUILLAJÆ. *U.S.* Tincture of Quillaja.

	Metric.	Old form.
Quillaja, coarsely ground	200 Gm.	6 oz. av. 296 grains.
Alcohol	350 C.c.	11 fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Boil the Quillaja, placed in a suitable vessel, with 800 C.c. [old form 25½ fl. oz.] of Water for fifteen minutes, strain, and wash the residue on the strainer with 100 C.c. [old form 3¼ fl. oz.] of Water. Then boil the strained liquid down to 600 C.c. [old form 19 fl. oz.], allow it to cool, mix it with the Alcohol, and, when the insoluble matter has subsided, filter the liquid portion through paper, and add enough Water to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA RHEI. *U.S.* Tincture of Rhubarb.

	Metric.	Old form.
Rhubarb	100 Gm.	8 oz. av. 148 grains.
Cardamom	20 Gm.	292 grains.
Glycerin	100 C.c.	3¼ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Rhubarb and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the Glycerin with 600 C.c. [old form 19¼ fl. oz.] of Alcohol and 300 C.c. [old form 9½ fl. oz.] of Water. Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of Alcohol and Water, made in the same proportions as before, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA RHEI AROMATICA. *U.S.* Aromatic Tincture of Rhubarb.

	Metric.	Old form.
Rhubarb	200 Gm.	6 oz. av. 296 grains.
Cassia Cinnamon	40 Gm.	1 oz. av. 148 grains.
Cloves	40 Gm.	1 oz. av. 148 grains.
Nutmeg	20 Gm.	292 grains.
Glycerin	100 C.c.	3¼ fl. oz.
Alcohol,		
Water,		
Diluted Alcohol, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Rhubarb, Cinnamon, Cloves, and Nutmeg, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the Glycerin with 500 C.c. [old form 16 fl. oz.] of Alcohol and 400 C.c. [old form 13 fl. oz.] of Water. Moisten the powder with 150 C.c. [old form 5 fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA RHEI DULCIS. *U.S.* **Sweet Tincture of Rhubarb.**

	Metric.	Old form.
Rhubarb	100 Gm.	8 oz. av. 148 grains.
Glycyrrhiza	40 Gm.	1 oz. av. 148 grains.
Anise	40 Gm.	1 oz. av. 148 grains.
Cardamom	10 Gm.	146 grains.
Glycerin	100 C.c.	3¼ fl. oz.
Alcohol,		
Water,		
Diluted Alcohol, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Rhubarb, Glycyrrhiza, Anise, and Cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the Glycerin with 500 C.c. [old form 16 fl. oz.] of Alcohol and 400 C.c. [old form 13 fl. oz.] of Water. Moisten the powder with 150 C.c. [old form 5 fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA SANGUINARIÆ. *U.S.* **Tincture of Sanguinaria.**

	Metric.	Old form.
Sanguinaria, in No. 60 powder	150 Gm.	5 oz. av.
Acetic Acid	20 C.c.	5 fl. dr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 600 C.c. [old form 19 fl. oz.] of Alcohol to 400 C.c. [old form 13 fl. oz.] of Water. Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of the mixture to which the Acetic Acid had previously been added, and macerate for twenty-four hours; then pack it firmly in a cylindrical glass percolator, gradually pour on more of a mixture of Alcohol and Water, made in the same proportions as before, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA SCILLÆ. *U.S.* Tincture of Squill.

	Metric.	Old form.
Squill, in No. 80 powder	150 Gm.	5 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 750 C.c. [old form 24 fl. oz.] of Alcohol to 250 C.c. [old form 8 fl. oz.] of Water. Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it moderately in a conical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA SERPENTARIÆ. *U.S.* Tincture of Serpentaria.

	Metric.	Old form.
Serpentaria, in No. 40 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA STRAMONII SEMINIS. *U.S.* Tincture of Stramonium Seed.

[TINCTURA STRAMONII, PHARM. 1880.]

	Metric.	Old form.
Stramonium Seed, in No. 40 powder	150 Gm.	5 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of Diluted Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Diluted Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA STROPHANTHI. *U.S.* Tincture of Strophanthus.

	Metric.	Old form.
Strophanthus, in No. 80 powder	50 Gm.	1 oz. av. 292 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Digest the powder with 70 C.c. [old form 2¼ fl. oz.] of the menstruum for two days, then transfer it to a cylindrical percolator, gradually pour

menstruum upon it, and continue the percolation very slowly, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA SUMBUL. *U. S.* **Tincture of Sumbul.**

	Metric.	Old form.
Sumbul, in No. 30 powder	100 Gm.	3 oz. av. 148 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Moisten the powder with 100 C.c. [old form 3½ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA TOLUTANA. *U. S.* **Tincture of Tolu.**

	Metric.	Old form.
Balsam of Tolu	100 Gm.	3 oz av. 148 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Add the Balsam of Tolu to 900 C.c. [old form 29 fl. oz.] of Alcohol, and macerate until it is dissolved; then filter through paper, adding, through the filter, enough Alcohol to make the Tincture measure 1000 C.c. [old form 2 pints].

TINCTURA VALERIANÆ. *U. S.* **Tincture of Valerian.**

	Metric.	Old form.
Valerian, in No. 60 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 750 C.c. [old form 24 fl. oz.] of Alcohol to 250 C.c. [old form 8 fl. oz.] of Water. Moisten the powder with 100 C.c. [old form 3½ fl. oz.] of the menstruum, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA VALERIANÆ AMMONIATA. *U. S.* **Ammoniated Tincture of Valerian.**

	Metric.	Old form.
Valerian, in No. 60 powder	200 Gm.	6 oz. av. 296 gr.
Aromatic Spirit of Ammonia, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 200 C.c. [old form 6½ fl. oz.] of Aromatic Spirit of Ammonia, and macerate for twenty-four hours, in a closed

vessel; then pack it firmly in a cylindrical glass percolator, and gradually pour Aromatic Spirit of Ammonia upon it, keeping the percolator well covered, until 100 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA VANILLÆ. *U. S.* Tincture of Vanilla.

	Metric.	Old form.
Vanilla, cut into small pieces and bruised . . .	100 Gm.	3 oz. av. 148 gr.
Sugar, in coarse powder	200 Gm.	6 oz. av. 296 gr.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix Alcohol and Water in the proportion of 650 C.c. [old form 21 fl. oz.] of Alcohol to 350 C.c. [old form 11 fl. oz.] of Water. Macerate the Vanilla in 500 C.c. [old form 16 fl. oz.] of this mixture for twelve hours, then drain off the liquid, and set it aside. Transfer the Vanilla to a mortar, beat it with the Sugar into a uniform powder, then pack it in a percolator, and pour upon it the reserved liquid. When this has disappeared from the surface, gradually pour on menstruum, and continue the percolation, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA VERATRI VIRIDIS. *U. S.* Tincture of Veratrum Viride.

	Metric.	Old form.
Veratrum Viride, in No. 60 powder	400 Gm.	13 oz. av. 155 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the powder with 150 C.c. [old form 5 fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

TINCTURA ZINGIBERIS. *U. S.* Tincture of Ginger.

	Metric.	Old form.
Ginger, in No. 40 powder	200 Gm.	6 oz. av. 296 gr.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Moisten the Ginger with 50 C.c. [old form 1½ fl. oz.] of Alcohol, and macerate for twenty-four hours; then pack it firmly in a cylindrical percolator, and gradually pour Alcohol upon it, until 1000 C.c. [old form 2 pints] of Tincture are obtained.

Vina Medicata. *Medicated Wines.*

These are liquid preparations containing the soluble principles of medicinal substances dissolved in wine. Pharmaceutically they most resemble tinctures, differing from them merely in the character of the menstruum. The fermented juice of the grape, known officially as "vinum album," or "white wine," when brought to a definite alcoholic strength, is the menstruum used as the basis for medicated wines; and

wines have the advantage over infusions and decoctions of being much more permanent preparations, on account of the presence of alcohol.

The stability of medicated wines was greatly improved by the requirement of the U. S. P. 1880 that they should be made from stronger white wine, a menstruum containing from twenty to twenty-five per cent. of absolute alcohol by weight. The U. S. P. 1890 requires the addition of alcohol or of an alcoholic tincture to every medicated wine. It is apparent that more useful and permanent preparations could be made by substituting a menstruum composed of alcohol and water, and hence tinctures are preferable. Of the *ten* official wines, *two* are not medicated, *four* are made by solution or admixture, *two* by maceration, and *two* by percolation.

Table of the Official Wines.

Name.	Definition and Proportions.
Not Medicated.	
Vinum Album.	An alcoholic liquid, made by fermenting the juice of fresh grapes freed from seeds, stems, and skins.
Rubrum.	An alcoholic liquid, made by fermenting the juice of fresh, colored grapes, in presence of their skins.
Made by Solution.	
Vinum Antimonii.	4 Gm. Antimony and Potassium Tartrate; 65 C.c. Boiling Distilled Water; 150 C.c. Alcohol; White Wine, to make 1000 C.c.
Ferri Amarum.	50 Gm. Soluble Iron and Quinine Citrate; 150 C.c. Tincture of Sweet Orange Peel; 300 C c. Syrup; White Wine, to make 1000 C.c.
Ferri Citratis.	40 Gm. Iron and Ammonium Citrate; 150 C.c. Tincture of Sweet Orange Peel; 100 C.c. Syrup; White Wine, to make 1000 C.c.
Ipecacuanhæ.	100 C.c. Fluid Extract of Ipecac; 100 C.c. Alcohol; 800 C.c. White Wine.
Made by Maceration.	
Vinum Colchici Seminis.	150 Gm. Colchicum Seed; 150 C.c. Alcohol; White Wine, to make 1000 C.c.
Opii.	100 Gm. Powdered Opium; 10 Gm. Cassia Cinnamon; 10 Gm. Cloves; 150 C.c. Alcohol; White Wine, to make 1000 C.c.
Made by Percolation.	
Vinum Colchici Radicis.	400 Gm. Colchicum Root; 150 C.c. Alcohol; White Wine, to make 1000 C.c.
Ergotæ.	150 Gm. Ergot; 150 C.c. Alcohol; White Wine, to make 1000 C.c.

VINUM ALBUM. *U. S.* White Wine.

An alcoholic liquid, made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* (nat. ord. *Vitaceæ*), freed from seeds, stems, and skins.

When White Wine is prescribed without further specification, it is recommended that a dry White Wine of domestic production (such as California Riesling, Ohio Catawba, etc.) be employed.

White Wine should be preserved in well-closed casks, filled as full as possible, or in well-stoppered bottles, in a cool place. It should contain not less than 10 nor more than 14 per cent., by weight (equivalent to 12.4 to 17.3 per cent. by volume), of absolute alcohol.

VINUM ANTIMONII. *U. S.* Wine of Antimony.

	Metric.	Old form.
Antimony and Potassium Tartrate	4 Gm.	58½ grains.
Boiling Distilled Water	65 C.c.	2 fl. oz.
Alcohol	150 C.c.	5 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Alcohol with 800 C.c. [old form 25½ fl. oz.] of White Wine. Dissolve the Antimony and Potassium Tartrate in the Boiling Distilled Water, and add the solution to the mixture. When the liquid is cold, filter it through paper, and add enough White Wine, through the filter, to make the product measure 1000 C.c. [old form 2 pints].

VINUM COLCHICI RADICIS. *U. S.* Wine of Colchicum Root.

	Metric.	Old form.
Colchicum Root, in No. 80 powder	400 Gm.	13 oz. av. 154 gr.
Alcohol	150 C.c.	5 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Alcohol with 850 C.c. [old form 27¼ fl. oz.] of White Wine. Moisten the powder with 100 C.c. [old form 3¼ fl. oz.] of the menstruum, pack it moderately in a conical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and afterwards enough White Wine to make the product measure 1000 C.c. [old form 2 pints].

VINUM COLCHICI SEMINIS. *U. S.* Wine of Colchicum Seed.

	Metric.	Old form.
Colchicum Seed, in No. 80 powder	150 Gm.	5 oz. av.
Alcohol	150 C.c.	5 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Alcohol with 850 C.c. [old form 27¼ fl. oz.] of White Wine. Macerate the powder with 900 C.c. [old form 29 fl. oz.] of the mixture during seven days, in a closed vessel, with occasional agitation. Then filter through paper, adding, through the filter, first, the remainder of the menstruum, and afterwards enough White Wine to make the product measure 1000 C.c. [old form 2 pints].

VINUM ERGOTÆ. *U. S.* Wine of Ergot.

	Metric.	Old form.
Ergot, recently ground and in No. 80 powder	150 Gm.	5 oz. av.
Alcohol	150 C.c.	5 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Alcohol with 850 C.c. [old form 27¼ fl. oz.] of White Wine. Moisten the powder with 40 C.c. [old form 1¼ fl. oz.] of the mixture, pack it moderately in a conical glass percolator, and

gradually pour upon it, first, the remainder of the menstruum, and afterwards enough White Wine to make the product measure 1000 C.c. [old form 2 pints].

VINUM FERRI AMARUM. *U. S.* **Bitter Wine of Iron.**

	Metric.	Old form.
Soluble Iron and Quinine Citrate	50 Gm.	780 grains.
Tincture of Sweet Orange Peel	150 C.c.	5 fl. oz.
Syrup	300 C.c.	10 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Soluble Iron and Quinine Citrate in 500 C.c. [old form 16 fl. oz.] of White Wine. Add to this the Tincture of Sweet Orange Peel and the Syrup, and, lastly, enough White Wine to make the product measure 1000 C.c. [old form 2 pints]. Set the mixture aside for several days, then filter, and pass enough White Wine through the filter to restore the original volume.

VINUM FERRI CITRATIS. *U. S.* **Wine of Ferric Citrate.**

	Metric.	Old form.
Iron and Ammonium Citrate	40 Gm.	584 grains.
Tincture of Sweet Orange Peel	150 C.c.	5 fl. oz.
Syrup	100 C.c.	8¼ fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Dissolve the Iron and Ammonium Citrate in 700 C.c. [old form 22½ fl. oz.] of White Wine. Add to this the Tincture of Sweet Orange Peel, and the Syrup, and, lastly, enough White Wine to make the product measure 1000 C.c. [old form 2 pints]. Set the mixture aside for several days, then filter, and pass enough White Wine through the filter to restore the original volume.

VINUM IPECACUANHÆ. *U. S.* **Wine of Ipecac.**

	Metric.	Old form.
Fluid Extract of Ipecac	100 C.c.	8¼ fl. oz.
Alcohol	100 C.c.	8¼ fl. oz.
White Wine	800 C.c.	25½ fl. oz.
To make	1000 C.c.	2 pints.

Mix them. Set the mixture aside for a few days, then filter.

VINUM OPII. *U. S.* **Wine of Opium.**

	Metric.	Old form.
Powdered Opium	100 Gm.	8 oz. av. 148 gr.
Cassia Cinnamon, in No. 60 powder	10 Gm.	146 grains.
Cloves, in No. 30 powder	10 Gm.	146 grains.
Alcohol	150 C.c.	5 fl. oz.
White Wine, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Alcohol with 850 C.c. [old form 27¼ fl. oz.] of White Wine. To the mixed powders add 900 C.c. [old form 29 fl. oz.] of the menstruum, and macerate during seven days, with occasional

agitation. Then transfer the mixture to a filter, and, when the liquid has drained off, gradually pass through the filter, first, the remainder of the menstruum, and afterwards enough White Wine to make the product measure 1000 C.c. [old form 2 pints].

If 100 C.c. of Wine of Opium be assayed by the process given under *Tinctura Opii*, it should yield from 1.3 to 1.5 Gm. of crystallized morphine.

VINUM RUBRUM. *U.S.* Red Wine.

An alcoholic liquid, made by fermenting the juice of fresh, colored grapes, the fruit of *Vitis vinifera* (nat. ord. *Vitaceæ*), in presence of their skins.

When Red Wine is prescribed without further specification, it is recommended that a dry Red Wine of domestic production (such as a native Claret, Burgundy, etc.) be employed.

Red Wine should be preserved in well-closed casks filled as full as possible, or in well-stoppered bottles, in a cool place.

A deep red liquid, having a pleasant odor free from yeastiness, and a fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive sweetness or acidity.

The specific gravity, at 15.6° C. (60° F.), should not be less than 0.989, nor more than 1.010.

If a portion of Red Wine be evaporated, the residue, when dried during twelve hours on a water-bath, should not amount to less than 1.6 per cent., nor more than 3.5 per cent.

To neutralize 50 C.c. of Red Wine should require not less than 3 nor more than 5 2 C.c. of normal potassium hydrate V.S. (limit of *free acid*), eosin or fluorescein being used as indicator.

If 10 C.c. of Red Wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., the liquid should acquire a brownish-green color (due to *tannic acid*).

With lead acetate T.S., Red Wine forms a heavy precipitate which may vary in color from bluish-green to green.

If 2 C.c. of Red Wine be mixed, in a test-tube, with 2 drops of chloroform and 4 C.c. of normal potassium hydrate V.S., and the mixture carefully heated, the disagreeable odor of isonitril should not become perceptible (absence of *various aniline colors*).

If 50 C.c. of Red Wine be treated with a slight excess of ammonia water, the liquid should acquire a green or brownish-green color; if it be then well shaken with 25 C.c. of ether, the greater portion of the ethereal layer removed, and evaporated in a porcelain capsule with an excess of acetic acid and a few fibres of uncolored silk, the latter should not acquire a crimson or violet color (absence of *fuchsine*).

If 25 C.c. of Red Wine, heated to about 45° C. (113° F.), be well agitated with 25 Gm. of manganese dioxide, the liquid filtered off and acidulated with hydrochloric acid, it should not acquire a red color (absence of *sulpho-fuchsine*).

Tested by the following method, Red Wine should be found to contain not less than 10 nor more than 14 per cent., by weight (equivalent to 12.4 to 17.3 per cent. by volume), of absolute alcohol.

Extracta Fluida. *Fluid Extracts.*

Fluid extracts are liquid alcoholic preparations of uniform and definite strength, made by percolating drugs with menstrua, and concentrating a portion of the percolate so that in each case a cubic centimetre represents the medicinal virtues of one gramme of the drug: they are mostly concentrated tinctures. Fluid extracts were official for the first time in 1850, and the list was then made up of *seven* concentrated preparations, although but *one* of these could be called a fluid extract within the present meaning of the term: of the seven, two were oleoresins,

four were concentrated syrups, and but one was a concentrated tincture. Since 1850 the use of fluid extracts has increased to an enormous extent: the Pharmacopœia of 1890 contains formulas for *eighty-eight*, the number being greater than that of any other class of preparations in the work. Fluid extracts may be justly called "American preparations," and the advance made in pharmacy in this country within the last quarter of a century is largely due to the stimulus given by the studies in percolation and the demand for these useful liquids. The striking advantages possessed by fluid extracts are—1. Permanence. 2. Concentration. 3. The uniform relation existing between the fluid extract and the drug.

Permanence is secured by the adoption of alcoholic menstrua: formerly, sugar and glycerin were relied upon as preservatives, but continued experience has developed the value of alcohol, so that at present it is exclusively used as the antiseptic.

Concentration enables the physician to decrease the bulk of the dose, diminishing the volume of the preparation so that portability is secured. It also aids greatly in securing permanence.

The uniform relation existing between the fluid extract and the drug is of great assistance to the physician in fixing the dose, because, as one cubic centimetre is represented by one gramme, the dose of the fluid extract must be practically the same as that of the drug. It has also obvious advantages in arranging the formulas and working from them. The present strength of fluid extracts renders them five per cent. weaker than the fluid extracts of U. S. P. 1870: this is practically of no significance, so long as the drugs themselves are not brought to a standard to limit the amount of moisture or active principles present; for there would be more variation than five per cent. between different lots of the same drug, in these particulars: indeed, the proposition to make fluid extracts just half their present strength has met with favor from many able pharmacists, the principal arguments being that more thorough exhaustion can be secured by the ordinary operator upon the small scale, and that the fluid extracts can be made to represent the drug more accurately and honestly when *one hundred* parts by measure are made from *fifty* parts by weight of drug than when one hundred parts by measure are made from one hundred parts by weight of drug. The standard of strength of the official fluid extracts is based upon the theory that from a given weight of drug an amount of fluid extract shall be made equal in measure to the bulk of the same weight of distilled water; in other words, the relation is that of gramme to cubic centimetre.

Preparation.—Fluid extracts are made in several ways. The manufacturer generally adopts a different process from that directed by the Pharmacopœia, because upon the large scale some practical modifications are necessary; the finished preparation is, however, generally brought to the official standard. The processes at present in use may be classified as follows: 1. Percolation with partial evaporation (official). 2. Percolation with incomplete exhaustion. 3. Repercolation. 4. Vacuum maceration with percolation.

1. Percolation with Partial Evaporation.—This process can be best described by selecting from the official formulas one which will serve as an example.

Typical Formula for an Official Fluid Extract.

1000 *Gm. of the powdered drug is moistened with a certain quantity of menstruum, packed in a suitable percolator, and enough menstruum added to saturate the powder and leave a stratum above it; the lower orifice of the percolator is closed when the liquid begins to drop, and the percolator is closely covered to prevent evaporation and permit maceration for a specified time; additional menstruum is poured on and percolation continued until the drug is exhausted. Usually about eight hundred C.c. of the first portion of the percolate is reserved, and the remainder evaporated at a temperature not exceeding* 50° *C.* (122° *F.*) *to a soft extract; this is to be dissolved in the reserved portion, and enough menstruum added to make the fluid extract measure* 1000° *C.c.* The precipitation experienced heretofore when the evaporated weak percolate was added to the reserved portion is considerably diminished by causing the former to be evaporated to a soft extract. This precipitation, formerly noticed more particularly in alcoholic fluid extracts, was due to the volatility of the alcohol in the weak percolates, which, when evaporated, left the residue to a great extent aqueous; when this residue was added to the strongly alcoholic reserved portion, a precipitation of resinous and frequently of active matter took place, which necessitated the storing of the fluid extract until precipitation ceased, and subsequent filtration. This is almost altogether avoided by evaporating to a soft extract, and the loss of activity through precipitation thus greatly diminished.

The argument is frequently advanced that the application of heat is detrimental to solutions of organic principles, that it dissociates some, and always proves injurious to the desirable constituents, *and that no heat whatever should be used in making fluid extracts:* these views are undoubtedly correct, when considered in connection with a few special cases, but do not apply with any practical force to the moderate use of heat recommended by the official processes upon that portion of the percolate which represents the least active and least desirable constituents of the drug; for from seven-tenths to nine-tenths of the whole amount of percolate (frequently representing ninety-five per cent. of the activity of the drug) is reserved and is not subjected to heat at all.

2. **Percolation with Incomplete Exhaustion.**—This process consists in percolating a given weight of a drug with the proper menstruum in the usual manner, and stopping the percolation when an amount of percolate has been received which is equal to about three-fourths of the weight of the drug. To illustrate: 1000 grammes, or 16 ounces, of drug is percolated with the menstruum until 750 C.c., or 12 fluidounces, of percolate has been received; this is the complete process, and the residue containing absorbed menstruum is sacrificed. This method has the merit of saving time and labor, and avoiding evaporation with the necessary contact of heat. It is based on the assumption that when percolation is properly conducted the first seventy-five per cent. of percolate received contains at least seventy-five per cent. of the soluble and desirable principles of the drug, and that the wastage of alcohol comes chiefly from the effort to obtain the last twenty-five per cent. or less of soluble principles. In addition, this smaller amount of extrac-

tive matter in the weak percolate is said to be lessened in activity by the effects of the heat during the evaporation to recover the alcohol from it: hence the argument that in carefully-conducted operations the active matter left after receiving the percolate representing seventy-five per cent. of the drug, does not represent twenty-five per cent. of activity, but oftentimes less than ten per cent. The principal disadvantage of this method is that the *strength* of the finished fluid extract depends *entirely* upon the *skill* and *care* of the operator. If careful, in one operation he may obtain seventy-five per cent. of the active principles in the first seventy-five per cent. of percolate; in another case, circumstances may prevent his obtaining more than fifty per cent. of the active principles in the first seventy-five per cent. of percolate. By this method of making fluid extracts he cannot invariably secure uniformity, whilst in making fluid extracts by the official process a valuable check always exists,—*i.e., that percolation proceeds until exhaustion is reached, the weak percolate is evaporated at a limited temperature, and the soft extract is incorporated with the reserved portion,* so that imperfect percolation happening in the first part of the process is compensated for in the latter part, the only difference being that the weak percolate in this case contains a larger proportion of activity than if the operation had been thoroughly conducted from the first.

3. **Repercolation.**—This process, already treated of under the head of percolation (see page 280), is an improvement upon the method just noticed, because the drug is percolated to exhaustion, and evaporation obviated by storing away the weak percolate until the next operation upon the same drug, when it is used in the place of fresh menstruum. This process may be best explained by selecting a typical fluid extract and noting the details.

Fluid Extract of Cinchona by Repercolation (Squibb).—Take of Yellow Cinchona, in powder No. 50, 32 parts; Stronger Alcohol, sp. gr. .819, 2 parts; Glycerin, sp. gr. 1.250, 1 part; Water, 2 parts, or a sufficient quantity of menstruum.

Weigh the Stronger Alcohol, Glycerin, and Water in succession, in any convenient quantity at a time, into a tared bottle, and mix them thoroughly for a menstruum.

Moisten 8 parts of the Cinchona with 8 parts of the menstruum, by thoroughly mixing them, and allow the mixture to stand 8 hours in a closely-covered vessel. Then pass the moist powder through a No. 8 sieve, and pack it firmly in a percolator. Pour menstruum on top until the mass is filled with liquid and a stratum remains on top unabsorbed; cover the percolator closely, and macerate for 48 hours. Then arrange the percolator for an automatic supply of menstruum, and start the percolation at such a rate as to give 1 part of percolate in about 4 hours. Reserve the first 6 parts of percolate, and continue the percolation until the Cinchona is exhausted, separating the percolate received after the reserved portion into fractions of about 8 parts each.

Moisten a second portion of 8 parts of the Cinchona with 8 parts of the weak percolate,—the first portion that was obtained next after the reserved percolate,—and allow the moist powder to stand for 8 hours in a vessel closely covered. Then pack it moderately in a percolator, and

supply the percolator automatically with the remaining fractions of the weak percolate in the order in which they were received, and finally with fresh menstruum, until the Cinchona is exhausted. Percolate in the same manner and at the same rate as with the first portion of Cinchona, and, reserving 8 parts of the first percolate, separate the weaker percolate into fractions of about 8 parts each.

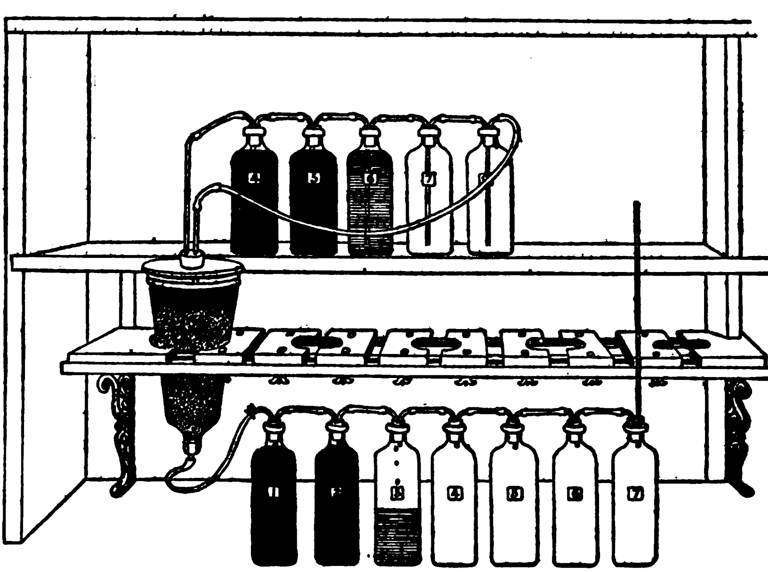
Percolate the third and fourth portions of 8 parts each of the Cinchona in the same way as the second portion.

Finally, mix the four reserved percolates together to make 30 parts of finished fluid extract; and, having corked, labelled, and numbered the bottles containing the fractions of weak percolate, set them away until the process for Cinchona is to be resumed.

When this fluid extract is to be again made, repeat the process as with the second portion, and reserve 8 parts of the first percolate as finished fluid extract from each 8 parts of Cinchona from that time forward so long as the fractions of weak percolate are carried forward with which to commence each operation.

Continuous Percolation.—Robert W. Beck has devised a modification of Dr. Squibb's method of repercolation with a view of rendering the process more suitable for the smaller operations carried on by retail pharmacists. The storing away of the last weak percolates, and

FIG. 344.



particularly the necessity for collecting the fractions of percolates, have operated to prevent repercolation from being used in small operations to the extent that it would be otherwise. Mr. Beck has sought to remove some of these disadvantages, and the illustration shown in Fig. 344 serves to render the explanations which follow more easily under-

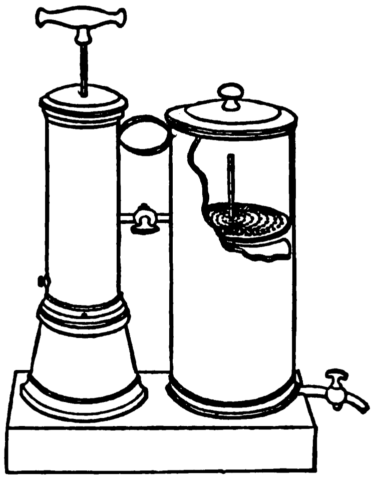
stood. His process and apparatus effect a saving in time and attention, and the difficulty of keeping the percolators containing the drugs supplied with the proper menstruum at the time when the portion previously added has just disappeared, has been overcome; the watchfulness necessary to see that each receiving vessel does not overflow, or get more than its due proportion of the weaker extract or menstruum, is reduced to a minimum, and the constant changing of receiving-bottles is no longer required. The continuous method is based on the principle of *connecting* the receiving-bottles containing the weaker percolates or menstruum, and after this to join the series to the percolator containing the drug by a syphon-tube so that the menstrua will flow slowly and regularly, and that each portion will be delivered on the upper surface of the drug in its proper order.

The percolate is carried from one receiving-bottle, when full, to the next one by tubes inserted in the corks from the neck of one bottle to the neck of the other. Very little diffusion occurs, owing to the fact that the heavier liquids are drawn off first, and in each case a lighter liquid is deposited slowly (by drops) upon a denser one; as the same principle is employed in receiving the percolates, the bottle nearest the percolator is filled with very dense percolate, and when the bottle is as full as desired, the tube connecting with the next bottle draws off the light liquid as it is deposited on top, and practically no intermixture occurs. Of course, the same action takes place in the remaining bottles of the series. If desired, the reserve or strongest percolate or finished fluid extract contained in the first bottles of the series can be removed, their place being supplied by empty bottles, so that even the slight risk of diffusion would apply only to weak percolates. In Fig. 344 the percolator is connected with No. 1 bottle by a rubber tube having a pinch-cock to regulate the flow; the remaining bottles are all connected in proper order by means of glass tubes and rubber tubing, as shown, the ends of the glass tubes being adjusted so as to be on the same level. When No. 1 bottle is full of dense percolate No. 2 bottle begins to fill with weaker percolate, then No. 3 with still weaker percolate, and so on. From the top of the last bottle on the upper shelf (No. 8) a piece of rubber tubing is connected with a glass tube having an inside diameter of ¼ inch, which passes through the cover of the percolator, the lower end about ⅛ inch above the surface of the drug. This device makes an automatic supply of menstruum, the latter ceasing to flow when the liquid rises in the percolator above the end of the supply-tube.

5. **Vacuum Maceration followed by Percolation.**—This method of making fluid extracts was proposed in 1869 by S. P. Duffield. His original process was to introduce the drug, ground to the requisite fineness, into a strong cylinder connected with an air-pump. The air was exhausted by the pump, and through a syphon-tube the requisite amount of menstruum was sucked into the vacuum-chamber. The air enclosed in the interstices and pores of the drug was thus expelled, and, the menstruum being brought immediately in contact with the soluble constituents, maceration was facilitated. The same process was suggested by Needles many years ago. Fig. 346 is an illustration of his original

apparatus, the vessel upon the right hand being the percolator and receiver, the pump for exhausting the receiver being connected by a short tube carrying a stop-cock. The most effective apparatus known to the author for using this principle upon the large scale is that devised by Wm. M. Thomson, of Philadelphia, and illustrated in the American Journal of Pharmacy, page 237, 1882. The percolators are egg-shaped, and made of tinned copper; they are capable of being tightly covered, and communicate with a very efficient double-acting air-pump by means of stop-cocks above and below, and iron and stout rubber tubing. The moistened powder is packed tightly in the percolator, and the cover securely bolted on. The stop-cock in the cover, communicating with the air-pump, is opened, and a partial vacuum created in the space above the moistened drug; it is then closed, and another stop-cock in the cover opened, which communicates by a tube with the reservoir containing the menstruum. The menstruum quickly penetrates the powder, taking the place of the interstitial air, and when the powder is saturated it is permitted to macerate *in vacuo* a sufficient length of time. To start percolation, a receiver is connected with the beak of the percolator, and the air exhausted from it. When the flow slackens, air may be forced by the pump into the space above the powder, and the receiver again exhausted below. In this way entire control of these powerful physical forces may be secured. The advantages are apparent in preventing the loss of alcohol and protecting from chemical change caused by exposure to the air. It is quite possible to make an official fluid extract without recourse to the subsequent evaporation of weak percolate.

FIG. 346.



Needles's vacuum percolator.

Preservation of Fluid Extracts.—Very little trouble is experienced in keeping fluid extracts which have been properly made. They should be placed in glass vessels and stored in rooms of uniform temperature: precipitation to a greater or less extent will certainly take place. This is often especially noticeable in fluid extracts made during warm weather, and is due to the greater solvent action of the menstruum at higher temperatures. Precipitation is also caused by the variation in the strength of different portions of the menstruum in an alcoholic fluid extract: the first part of the percolate which is received contains the displaced water which was present as moisture in the powder, and the mixture of this with the strong alcoholic percolate which follows causes in time precipitation. The character of the precipitates should be ascertained: if active, they should be incorporated by shaking with the fluid extract; if inert, they should be filtered out.

Official Fluid Extracts arranged in Classes according to the Alcoholic Strength of their Menstruums, with Manipulative Notes.

Name.	Number of C.c. used to Moisten.	Menstruum.	Number of C.c. of Reserve.	Process and Remarks.
Class 1.		**Alcohol.**		
Extractum Aromaticum Fluidum.	350	"	850	From Aromatic Powder.
Buchu.	400	"	850	
Calami.	350	"	900	Percolate with the menstruum directed until the drug is exhausted, reserving the number of C.c. set opposite each fluid extract in the proper column; evaporate or distil the rest of the percolate at a temperature not above 122° F. to a soft extract. Dissolve this in the reserved portion, and add sufficient Alcohol to make the whole measure 1000 C.c.
Cannabis Indicæ.	300	"	900	
Capsici.	500	"	900	
Cimicifugæ.	250	"	900	
Cubebæ.	200	"	900	
Cusso.	400	"	900	
Gelsemii.	300	"	900	
Grindeliæ.	300	"	850	
Iridis.	400	"	900	
Lupulini.	200	"	700	
Mezerei.	400	"	900	
Sabinæ.	250	"	900	
Veratri Viridis.	300	"	900	
Xanthoxyli.	250	"	900	
Zingiberis.	250	"	900	
Class 2.		**Alcohol, 4. Water, 1.**		
Belladonnæ Radicis.	350	" "	900	
Eriodictyi.	400	" "	900	
Podophylli.	300	" "	850	
Rhei.	400	" "	750	
Serpentariæ.	300	" "	900	Mix the Alcohol and Water, and exhaust the drug with the menstruum; reserve the number of C.c. directed, and distil or evaporate the remainder to a soft extract; add this to the reserved portion and sufficient menstruum to make the whole measure 1000 C.c.
Class 3.		**Alcohol, 3. Water, 1.**		
Aconiti.	400	" "	900	
Arnicæ Radicis.	400	" "	900	
Calumbæ.	300	" "	700	
Eucalypti.	400	" "	900	
Guaranæ.	200	" "	800	
Ipecacuanhæ.	350	" "	900	
Leptandræ.	400	" "	800	
Matico.	300	" "	850	
Nucis Vomicæ.	1000			
Sanguinariæ.	300	" "	850	
Scillæ.	200	" "	750	
Senegæ.	450	" "	850	With 5 p.c. Ammonia Water to menstruum, to dissolve Pectin.
Stramonii Seminis.	200	" "	900	
Valerianæ.	300	" "	850	
Viburni Opuli.	300	" "	850	
Viburni Prunifolii.	300	" "	850	Having moistened the powder, exhaust with the menstruum, reserve the number of C.c. directed, and distil or evaporate the remainder to a soft extract; add this to the reserved portion and sufficient menstruum to make the whole measure 1000 C.c.
Class 4.		**Alcohol, 2. Water, 1.**		
Aurantii Amari.	350	" "	800	
Chiratæ.	350	" "	850	
Colchici Radicis.	350	" "	850	
Colchici Seminis.	300	" "	850	
Digitalis.	400	" "	850	
Hyoscyami.	400	" "	900	
Menispermi.	400	" "	900	
Phytolaccæ.	400	" "	800	

Official Fluid Extracts.—(*Continued.*)

NAME.	Number of C.c. used to Moisten.	Menstruum.	Number of C.c. of Reserve.	Process and Remarks.
Class 5.		**Diluted Alcohol.**		
Extractum Asclepiadis Fluidum.	400	“ “	900	
Chimaphilæ.	400	“ “	700	
Cocæ.	450	“ “	800	
Conii.	300	“ “	900	With 2 p.c. Acetic Acid added to the menstruum to fix alkaloids.
Convallariæ.	400	“ “	800	
Cypripedii.	350	“ “	850	
Dulcamaræ.	400	“ “	800	
Ergotæ.	300	“ “	850	With 2 p.c. Acetic Acid added to the menstruum to fix alkaloids.
Eupatorii.	400	“ “	800	
Gentianæ.	350	“ “	800	
Lappæ.	400	“ “	800	
Lobeliæ.	350	“ “	850	
Pilocarpi.	350	“ “	850	
Rhamni Purshianæ.	400	“ “	800	
Rumicis.	350	“ “	800	Exhaust the drug with the menstruum, and, having reserved the number of C.c. directed, distil or evaporate the remainder of the percolate to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the whole measure 1000 C.c.
Scoparii.	350	“ “	850	
Scutellariæ.	350	“ “	800	
Sennæ.	400	“ “	800	
Spigeliæ.	300	“ “	850	
Stillingiæ.	300	“ “	850	
Taraxaci.	300	“ “	850	
Class 6.		**Alcohol, 50. Water, 80.**		
Frangulæ.	350	“ “	800	
Class 7.		**Alcohol, 1. Water, 2.**		
Quassiæ.	400	“ “	900	
Sarsaparillæ.	400	“ “	800	
Class 8.		**Alcohol, 30. Water, 65.**		
Glycyrrhizæ.	350	“ “	750	With 5 p.c. Ammonia Water to hold in solution the Glycyrrhizin.
Class 9.		**Containing Glycerin.**		
Cinchonæ.	350	Glycerin, 20; Alcohol, 80	750	Finish percolation with Diluted Alcohol.
Gossypii Radicis.	500	Glycerin, 25; Alcohol, 75	700	Finish percolation with Alcohol.
Pareiræ.	400	Glycerin, 10; Alcohol, 72; Water, 18	850	Finish percolation with Alcohol, 4; Water, 1.
Apocyni.	400	Glycerin, 10; Alcohol, 65; Water, 25	900	Finish percolation with Alcohol, 65; Water, 35.

Official Fluid Extracts.—(*Continued.*)

Name.	Number of C.c. used to Moisten.	Menstruum.	Number of C.c. of Reserve.	Process and Remarks.
Class 9 (*continued*).		Containing Glycerin.		
Extractum Aspidospermatis.	400	Glycerin, 10; Alcohol, 60; Water, 30	800	
Hydrastis.	300	Glycerin, 10; Alcohol, 60; Water, 30	850	Finish percolation with Alcohol, 2; Water, 1.
Rubi.	350	Glycerin, 10; Alcohol, 60; Water, 30	700	
Geranii.	350	Glycerin, 10; Dil. Alcohol,	700	
Krameriæ.	400	Glycerin, 10; Dil. Alcohol,	700	Finish percolation with Diluted Alcohol.
Rhois Glabræ.	350	Glycerin, 10; Dil. Alcohol,	600	
Rosæ.	400	Glycerin, 10; Dil. Alcohol,	750	
Hamamelidis.	350	Glycerin, 10; Alcohol, 50; Water, 30	850	Finish percolation with Alcohol, 5; Water, 3.
Sarsaparillæ Compositum.	400	Glycerin, 10; Alcohol, 30; Water, 60	800	Finish percolation with Alcohol, 1; Water, 2.
Uvæ Ursi.	400	Glycerin, 30; Alcohol, 20; Water, 50	900	Finish percolation with Alcohol, 2; Water, 5.
Pruni Virginianæ.	300	Glycerin, 10; Alcohol, 55; Water, 35	800	Macerate with a mixture of 1 volume of Glycerin and 2 volumes of Water. Finish the percolation with a mixture of 17 volumes of Alcohol and 3 volumes of Water. Evaporate the weak percolate to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the whole measure 1000 C.c.
Class 10.		Boiling Water.		
Tritici.		" "		Percolate the Triticum with Boiling Water until exhausted, evaporate to 750 C.c., add 250 C.c. Alcohol, filter, and add enough of a mixture of 1 volume of Alcohol with 3 volumes of Water to make the whole measure 1000 C.c.
Castaneæ.		" "		Macerate the Castanea with Boiling Water, express, percolate residue to exhaustion; mix liquids, evaporate, when cool add Alcohol, decant, filter remainder, evaporate united liquids to 700 C.c.; add 100 C.c. Glycerin and 200 C.c. Alcohol.

PRACTICAL PROCESSES FOR FLUID EXTRACTS.

EXTRACTUM ACONITI FLUIDUM. *U. S.* Fluid Extract of Aconite.

	Metric.	Old form.
Aconite, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Aconite is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM APOCYNI FLUIDUM. *U. S.* Fluid Extract of Apocynum.

	Metric.	Old form.
Apocynum, in No. 60 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 minims.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 650 C.c. [old form 31 fl. oz.] of Alcohol and 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards a mixture of Alcohol and Water, made in the proportion of 650 C.c. [old form 31 fl. oz.] of Alcohol to 350 C.c. [old form 17 fl. oz.] of Water, until the Apocynum is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ARNICÆ RADICIS FLUIDUM. *U.S.* **Fluid Extract of Arnica Root.**

	Metric.	Old form.
Arnica Root, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Arnica Root is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM AROMATICUM FLUIDUM. *U.S.* **Aromatic Fluid Extract.**

	Metric.	Old form.
Aromatic Powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Aromatic Powder is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ASCLEPIADIS FLUIDUM. *U.S.* **Fluid Extract of Asclepias.**

	Metric.	Old form.
Asclepias, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate

for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Asclepias is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ASPIDOSPERMATIS FLUIDUM. *U.S.* **Fluid Extract of Aspidosperma.**

	Metric.	Old form.
Aspidosperma, in No. 60 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 600 C.c. [old form 29 fl. oz.] of Alcohol and 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of Alcohol and Water, made in the proportion of 200 C.c. [old form 16 fl. oz.] of Alcohol to 100 C.c. [old form 8 fl. oz.] of Water, until the Aspidosperma is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM AURANTII AMARI FLUIDUM. *U.S.* **Fluid Extract of Bitter Orange Peel.**

	Metric.	Old form.
Bitter Orange Peel, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it moderately in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Orange Peel is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the

remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM BELLADONNÆ RADICIS FLUIDUM. *U. S.* **Fluid Extract of Belladonna Root.**

[EXTRACTUM BELLADONNÆ FLUIDUM, PHARM. 1880.]

	Metric.	Old form.
Belladonna Root, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 800 C.c. [old form 38½ fl. oz.] of Alcohol with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Belladonna Root is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM BUCHU FLUIDUM. *U. S.* **Fluid Extract of Buchu.**

	Metric.	Old form.
Buchu, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Buchu is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CALAMI FLUIDUM. *U. S.* **Fluid Extract of Calamus.**

	Metric.	Old form.
Calamus, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Calamus is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CALUMBÆ FLUIDUM. *U. S.* **Fluid Extract of Calumba.**

	Metric.	Old form.
Calumba, in No. 20 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Calumba is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CANNABIS INDICÆ FLUIDUM. *U. S.* **Fluid Extract of Indian Cannabis.**

	Metric.	Old form.
Indian Cannabis, in No. 20 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Indian Cannabis is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue, in a porcelain capsule, to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CAPSICI FLUIDUM. *U. S.* **Fluid Extract of Capsicum.**

	Metric.	Old form.
Capsicum, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 500 C.c. [old form 24 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Capsicum is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CASTANEÆ FLUIDUM. *U. S.* **Fluid Extract of Castanea.**

	Metric.	Old form.
Castanea, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Pour 5000 C.c. [old form 15 pints] of boiling Water upon the powder, allow it to macerate for two hours, then express the liquid, transfer the residue to a percolator, and pour Water upon it until the powder is exhausted. Evaporate the united liquids, on a water-bath, to 2000 C.c. [old form 6 pints], allow this to cool, and add 600 C.c. [old form 29 fl. oz.] of Alcohol. When the insoluble matter has subsided, separate the clear liquid, filter the remainder, evaporate the united liquids to 700 C.c. [old form 33½ fl. oz.], allow this to cool, add the Glycerin, and enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CHIMAPHILÆ FLUIDUM. *U. S.* **Fluid Extract of Chimaphila.**

	Metric.	Old form.
Chimaphila, in No. 30 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Chimaphila is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate, and evaporate the

remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CHIRATÆ FLUIDUM. *U.S.* Fluid Extract of Chirata.

	Metric.	Old form.
Chirata, in No. 30 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Chirata is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CIMICIFUGÆ FLUIDUM. *U.S.* Fluid Extract of Cimicifuga.

	Metric.	Old form.
Cimicifuga, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 250 C.c. [old form 12 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cimicifuga is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CINCHONÆ FLUIDUM. *U.S.* Fluid Extract of Cinchona.

	Metric.	Old form.
Cinchona, in No. 60 powder	1000 Gm.	50 oz. av.
Glycerin	200 C.c.	9 fl. oz. 288 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 800 C.c. [old form 38½ fl. oz.] of Alcohol. Moisten the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, and when the liquid in the percolator has disappeared from the surface, gradually pour on a mixture of Alcohol and Water, made in the proportion of 800 C.c. [old form 38½ fl. oz.] of Alcohol to 200 C.c. [old form 9½ fl. oz.] of Water, and continue the percolation until the Cinchona is exhausted. Reserve the first 750 C.c. [old form 36 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the same proportions as before, to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM COCÆ FLUIDUM. *U. S.* **Fluid Extract of Coca.**

	Metric.	Old form.
Coca, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 450 C.c. [old form 21½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Coca is exhausted. Reserve the first 800 C.c. [old form 38 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM COLCHICI RADICIS FLUIDUM. *U. S.* **Fluid Extract of Colchicum Root.**

	Metric.	Old form.
Colchicum Root, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Colchicum Root is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the

percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM COLCHICI SEMINIS FLUIDUM. *U. S.* Fluid Extract of Colchicum Seed.

	Metric.	Old form.
Colchicum Seed, in No. 80 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form $14\frac{1}{2}$ fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form $14\frac{1}{2}$ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Colchicum Seed is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CONII FLUIDUM. *U. S.* Fluid Extract of Conium.

	Metric.	Old form.
Conium, in No. 40 powder.	1000 Gm.	50 oz. av.
Acetic Acid	20 C.c.	1 fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make.	1000 C.c.	8 pints.

Mix the Acetic Acid with 980 C.c. [old form 47 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 300 C.c. [old form $14\frac{1}{2}$ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Conium is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CONVALLARIÆ FLUIDUM. *U. S.* Fluid Extract of Convallaria.

	Metric.	Old form.
Convallaria, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Convallaria is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CUBEBÆ FLUIDUM. *U.S.* **Fluid Extract of Cubeb.**

	Metric.	Old form.
Cubeb, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 200 C.c. [old form 9½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cubeb is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CUSSO FLUIDUM. *U.S.* **Fluid Extract of Kousso.**
[EXTRACTUM BRAYERÆ FLUIDUM, PHARM. 1880.]

	Metric.	Old form.
Kousso, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Kousso is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM CYPRIPEDII FLUIDUM. *U.S.* **Fluid Extract of Cypripedium.**

	Metric.	Old form.
Cypripedium, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Cypripedium is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM DIGITALIS FLUIDUM. *U.S.* **Fluid Extract of Digitalis.**

	Metric.	Old form.
Digitalis, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Digitalis is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM DULCAMARÆ FLUIDUM. *U.S.* **Fluid Extract of Dulcamara.**

	Metric.	Old form.
Dulcamara, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Dulcamara is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ERGOTÆ FLUIDUM. *U. S.* **Fluid Extract of Ergot.**

	Metric.	Old form.
Ergot, recently ground and in No. 60 powder	1000 Gm.	50 oz. av.
Acetic Acid	20 C.c.	1 fl. oz.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix the Acetic Acid with 980 C.c. [old form 47 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the mixture to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Ergot is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ERIODICTYI FLUIDUM. *U. S.* **Fluid Extract of Eriodictyon.**

	Metric.	Old form.
Eriodictyon, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 800 C.c. [old form 38½ fl. oz.] of Alcohol with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Eriodictyon is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM EUCALYPTI FLUIDUM. *U. S.* **Fluid Extract of Eucalyptus.**

	Metric.	Old form.
Eucalyptus, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Eucalyptus is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM EUPATORII FLUIDUM. *U.S.* Fluid Extract of Eupatorium.

	Metric.	Old form.
Eupatorium, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Eupatorium is exhausted. Reserve the first 800 C.c. [old form 38 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM FRANGULÆ FLUIDUM. *U.S.* Fluid Extract of Frangula.

	Metric.	Old form.
Frangula, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 500 C.c. [old form 24 fl. oz.] of Alcohol with 800 C.c. [old form 38½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Frangula is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved

portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GELSEMII FLUIDUM. *U.S.* **Fluid Extract of Gelsemium.**

	Metric.	Old form.
Gelsemium, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Gelsemium is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GENTIANÆ FLUIDUM. *U.S.* **Fluid Extract of Gentian.**

	Metric.	Old form.
Gentian, in No. 30 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Gentian is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GERANII FLUIDUM. *U.S.* **Fluid Extract of Geranium.**

	Metric.	Old form.
Geranium, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 900 C.c. [old form 43 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator,

macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards Diluted Alcohol, until the Geranium is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GLYCYRRHIZÆ FLUIDUM. *U. S.* Fluid Extract of Glycyrrhiza.

	Metric.	Old form.
Glycyrrhiza, in No. 40 powder	1000 Gm.	50 oz. av.
Ammonia Water	50 C.c.	2½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Ammonia Water with 300 C.c. [old form 14½ fl. oz.] of Alcohol and 650 C.c. [old form 31 fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of Alcohol and Water made in the proportion of 300 C.c. [old form 14½ fl. oz.] of Alcohol and 650 C.c. [old form 31 fl. oz.] of Water, until the Glycyrrhiza is exhausted. Reserve the first 750 C.c. [old form 36 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of the mixture of Alcohol and Water to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GOSSYPII RADICIS FLUIDUM. *U. S.* Fluid Extract of Cotton Root Bark.

	Metric.	Old form.
Cotton Root Bark, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	250 C.c.	12 fl. oz.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 750 C.c. [old form 36 fl. oz.] of Alcohol, and, having moistened the powder with 500 C.c. [old form 24 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Alcohol, until the Cotton Root Bark is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate, and evaporate the remainder to a

soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GRINDELIÆ FLUIDUM. *U. S.* **Fluid Extract of Grindelia.**

	Metric.	Old form.
Grindelia, in No. 80 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Grindelia is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM GUARANÆ FLUIDUM. *U. S.* **Fluid Extract of Guarana.**

	Metric.	Old form.
Guarana, in No. 80 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 200 C.c. [old form 9½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Guarana is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM HAMAMELIDIS FLUIDUM. *U. S.* **Fluid Extract of Hamamelis.**

	Metric.	Old form.
Hamamelis, in No. 40 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 500 C.c. [old form 24 fl. oz.] of Alcohol and 800 C.c. [old form 38½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of Alcohol and Water, made in the proportion of 500 C.c. [old form 24 fl. oz.] of Alcohol to 800 C.c. [old form 38½ fl. oz.] of Water, until the Hamamelis is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM HYDRASTIS FLUIDUM. *U.S.* **Fluid Extract of Hydrastis.**

	Metric.	Old form.
Hydrastis, in No. 60 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 600 C.c. [old form 29 fl. oz.] of Alcohol and 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of Alcohol and Water, made in the proportion of 600 C.c. [old form 29 fl. oz.] of Alcohol to 300 C.c. [old form 14½ fl. oz.] of Water, until the Hydrastis is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM HYOSCYAMI FLUIDUM. *U.S.* **Fluid Extract of Hyoscyamus.**

	Metric.	Old form.
Hyoscyamus, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 2000 C.c. [old form 6 pints] of Alcohol with 1000 C.c. [old form 3 pints] of Water, and, having moistened the powder with 400

C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Hyoscyamus is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM IPECACUANHÆ FLUIDUM. *U.S.* **Fluid Extract of Ipecac.**

	Metric.	Old form.
Ipecac, in No. 80 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Ipecac is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM IRIDIS FLUIDUM. *U.S.* **Fluid Extract of Iris.**

	Metric.	Old form.
Iris, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Iris is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue, on a water-bath, to a soft

extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM KRAMERIÆ FLUIDUM. *U. S.* Fluid Extract of Krameria.

	Metric.	Old form.
Krameria, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 900 C.c. [old form 43 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards Diluted Alcohol, until the Krameria is exhausted. Reserve the first 700 C.c. [old form 34 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM LAPPÆ FLUIDUM. *U. S.* Fluid Extract of Lappa.

	Metric.	Old form.
Lappa, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Lappa is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM LEPTANDRÆ FLUIDUM. *U. S.* Fluid Extract of Leptandra.

	Metric.	Old form.
Leptandra, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Leptandra is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM LOBELIÆ FLUIDUM. *U.S.* **Fluid Extract of Lobelia.**

	Metric.	Old form.
Lobelia, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Lobelia is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM LUPULINI FLUIDUM. *U.S.* **Fluid Extract of Lupulin.**

	Metric.	Old form.
Lupulin	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the Lupulin with 200 C.c. [old form 9½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the Lupulin and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Lupulin is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM MATICO FLUIDUM. *U.S.* **Fluid Extract of Matico.**

	Metric.	Old form.
Matico, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Matico is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM MENISPERMI FLUIDUM. *U.S.* **Fluid Extract of Menispermum.**

	Metric.	Old form.
Menispermum, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Menispermum is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM MEZEREI FLUIDUM. *U.S.* **Fluid Extract of Mezereum.**

	Metric.	Old form.
Mezereum, in No. 30 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alco-

hol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Mezereum is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM NUCIS VOMICÆ FLUIDUM. *U.S.* **Fluid Extract of Nux Vomica.**

	Metric.	Old form.
Nux Vomica, in No. 60 powder	1000 Gm.	50 oz. av.
Acetic Acid	50 C.c.	$2\frac{1}{2}$ fl. oz.
Alcohol,		
Water, each, a sufficient quantity.		

Mix Alcohol and Water in the proportion of 750 C.c. [old form 36 fl. oz.] of Alcohol and 250 C.c. [old form 12 fl. oz.] of Water. Moisten the powder with 1000 C.c. [old form 3 pints] of the mixture, to which the Acetic Acid had previously been added, and let it digest, in a well-covered vessel, in a warm place, during forty-eight hours. Then pack it in a cylindrical glass percolator, and gradually pour menstruum upon it, until the Nux Vomica is practically exhausted. Distil off the Alcohol by means of a water-bath, transfer the remainder to a tared capsule, evaporate it until it weighs about 200 Gm. [old form 10 oz. av.], and allow it to become cold. Then determine the weight exactly, remove 4 Gm. of the mass, and assay this by the process given under Extract of Nux Vomica (see *Extractum Nucis Vomicæ*), using the amounts of liquids there directed for 2 Gm. of dry extract. From the results thus obtained ascertain, by calculation, the amount of total alkaloids in the remainder of the mass, and then add to the latter, first, 300 C.c. [old form $14\frac{1}{2}$ fl. oz.] of Alcohol, and afterwards a sufficient quantity of a mixture of 3 volumes of Alcohol and 1 volume of Water, so that each 100 C.c. of the finished fluid extract shall contain 1.5 Gm. of total alkaloids.

EXTRACTUM PAREIRÆ FLUIDUM. *U.S.* **Fluid Extract of Pareira.**

	Metric.	Old form.
Pareira, in No. 40 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 720 C.c. [old form $34\frac{1}{2}$ fl. oz.] of Alcohol and 180 C.c. [old form $8\frac{1}{2}$ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it

firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards a mixture of Alcohol and Water, made in the proportion of 400 C.c. [old form 20 fl. oz.] of Alcohol to 100 C.c. [old form 5 fl. oz.] of Water, until the Pareira is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM PHYTOLACCÆ RADICIS FLUIDUM. *U.S.* Fluid Extract of Phytolacca Root.

	Metric.	Old form.
Phytolacca Root, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 600 C.c. [old form 29 fl. oz.] of Alcohol with 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Phytolacca Root is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM PILOCARPI FLUIDUM. *U.S.* Fluid Extract of Pilocarpus.

	Metric.	Old form.
Pilocarpus, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually

adding Diluted Alcohol, until the Pilocarpus is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM PODOPHYLLI FLUIDUM. *U.S.* Fluid Extract of Podophyllum.

	Metric.	Old form.
Podophyllum, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 800 C.c. [old form 38½ fl. oz.] of Alcohol with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Podophyllum is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM PRUNI VIRGINIANÆ FLUIDUM. *U.S.* Fluid Extract of Wild Cherry.

	Metric.	Old form.
Wild Cherry, in No. 20 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix the Glycerin with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with the mixture, pack it firmly in a cylindrical glass percolator, and, having closely covered the percolator, macerate for forty-eight hours; then gradually add menstruum, made in the proportion of 850 C.c. [old form 41 fl. oz.] of Alcohol to 150 C.c. [old form 7 fl. oz.] of Water, and allow the percolation to proceed until the Wild Cherry is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM QUASSIÆ FLUIDUM. *U. S.* **Fluid Extract of Quassia.**

	Metric.	Old form.
Quassia, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 300 C.c. [old form 14½ fl. oz.] of Alcohol with 600 C.c. [old form 29 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Quassia is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM RHAMNI PURSHIANÆ FLUIDUM. *U. S.* **Fluid Extract of Rhamnus Purshiana.**

	Metric.	Old form.
Rhamnus Purshiana, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Rhamnus Purshiana is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM RHEI FLUIDUM. *U. S.* **Fluid Extract of Rhubarb.**

	Metric.	Old form.
Rhubarb, in No. 30 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 800 C.c. [old form 38 fl. oz.] of Alcohol with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a conical percolator; then add enough menstruum to saturate the powder

and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Rhubarb is exhausted. Reserve the first 750 C.c. [old form 36 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 70° C. (158° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM RHOIS GLABRÆ FLUIDUM. *U.S.* **Fluid Extract of Rhus Glabra.**

	Metric.	Old form.
Rhus Glabra, in No. 40 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 900 C.c. [old form 43 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards Diluted Alcohol, until the Rhus Glabra is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ROSÆ FLUIDUM. *U. S.* **Fluid Extract of Rose.**

	Metric.	Old form.
Red Rose, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 900 C.c. [old form 43 fl. oz.] of Diluted Alcohol, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards Diluted Alcohol, until the Red Rose is exhausted. Reserve the first 750 C.c. [old form 36 fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion,

and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM RUBI FLUIDUM. *U. S.* **Fluid Extract of Rubus.**

	Metric.	Old form.
Rubus, in No. 60 powder	1000 Gm.	50 oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 600 C.c. [old form 29 fl. oz.] of Alcohol and 300 C.c. [old form 14½ fl. oz.] of Water, and, having moistened the powder with 350 C.c. [old form 17 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards a mixture of Alcohol and Water, made in the proportion of 600 C.c. [old form 28 fl. oz.] of Alcohol to 300 C.c. [old form 14 fl. oz.] of Water, until the Rubus is exhausted. Reserve the first 700 C.c. [old form 33½ fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the last-named proportions, to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM RUMICIS FLUIDUM. *U. S.* **Fluid Extract of Rumex.**

	Metric.	Old form.
Rumex, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Rumex is exhausted. Reserve the first 800 C.c. [old form 39 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SABINÆ FLUIDUM. *U. S.* **Fluid Extract of Savine.**

	Metric.	Old form.
Savine, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 250 C.c. [old form 12 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Savine is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SANGUINARIÆ FLUIDUM. *U. S.* **Fluid Extract of Sanguinaria.**

	Metric.	Old form.
Sanguinaria, in No. 60 powder	1000 Gm.	50 oz. av.
Acetic Acid	50 C.c.	2½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix Alcohol and Water in the proportion of 750 C.c. [old form 36 fl. oz.] of Alcohol and 250 C.c. [old form 12 fl. oz.] of Water. Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, to which the Acetic Acid had previously been added, and let it macerate, in a well-covered vessel, in a warm place, during forty-eight hours. Then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the Sanguinaria is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SARSAPARILLÆ FLUIDUM. *U. S.* **Fluid Extract of Sarsaparilla.**

	Metric.	Old form.
Sarsaparilla, in No. 30 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 300 C.c. [old form 14½ fl. oz.] of Alcohol with 600 C.c. [old form 29 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Sarsaparilla is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and

evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SARSAPARILLÆ FLUIDUM COMPOSITUM. *U.S.*

Compound Fluid Extract of Sarsaparilla.

	Metric.	Old form.
Sarsaparilla, in No. 30 powder	750 Gm.	37½ oz. av.
Glycyrrhiza, in No. 30 powder	120 Gm.	6 oz. av.
Sassafras, in No. 30 powder	100 Gm.	5 oz. av.
Mezereum, in No. 30 powder	30 Gm.	1½ oz. av.
Glycerin	100 C.c.	4 fl. oz. 384 min.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 300 C.c. [old form 14½ fl. oz.] of Alcohol and 600 C.c. [old form 29 fl. oz.] of Water, and, having moistened the mixed powders with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards a mixture of Alcohol and Water, made in the proportion of 300 C.c. [old form 14½ fl. oz.] of Alcohol to 600 C.c. [old form 29 fl. oz.] of Water, until the powder is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of Alcohol and Water, using the last-named proportions, to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SCILLÆ FLUIDUM. *U.S.* Fluid Extract of Squill.

	Metric.	Old form.
Squill, in No. 20 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 200 C.c. [old form 9½ fl. oz.] of the mixture, pack it in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Squill is exhausted. Reserve the first 750 C.c. [old form 36 fl. oz.] of the percolate, and evaporate the

remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SCOPARII FLUIDUM. *U. S.* **Fluid Extract of Scoparius.**

	Metric.	Old form.
Scoparius, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, using the same proportions of Alcohol and Water as before, until the Scoparius is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SCUTELLARIÆ FLUIDUM. *U. S.* **Fluid Extract of Scutellaria.**

	Metric.	Old form.
Scutellaria, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 350 C.c. [old form 17 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Scutellaria is exhausted. Reserve the first 800 C.c. [old form 38 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SENEGÆ FLUIDUM. *U. S.* **Fluid Extract of Senega.**

	Metric.	Old form.
Senega, in No 40 powder	1000 Gm.	50 oz. av.
Ammonia Water	50 C.c.	2½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Ammonia Water with 750 C.c. [old form 36 fl. oz.] of Alcohol and 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 450 C.c. [old form 21½ fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of Alcohol and Water, made in the proportion of 750 C.c. [old form 36 fl. oz.] of Alcohol to 250 C.c. [old form 12 fl. oz.] of Water, until the Senega is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, to a soft extract; dissolve this in the reserved portion, and add enough of the last-mentioned mixture of Alcohol and Water to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SENNÆ FLUIDUM. *U.S.* **Fluid Extract of Senna.**

	Metric.	Old form.
Senna, in No. 30 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 400 C.c. [old form 19 fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Senna is exhausted. Reserve the first 800 C.c. [old form 38½ fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SERPENTARIÆ FLUIDUM. *U.S.* **Fluid Extract of Serpentaria.**

	Metric.	Old form.
Serpentaria, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 800 C.c. [old form 38 fl. oz.] of Alcohol with 200 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the

same proportions of Alcohol and Water as before, until the Serpentaria is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM SPIGELIÆ FLUIDUM. *U.S.* **Fluid Extract of Spigelia.**

	Metric.	Old form.
Spigelia, in No. 60 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Spigelia is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM STILLINGIÆ FLUIDUM. *U.S.* **Fluid Extract of Stillingia.**

	Metric.	Old form.
Stillingia, in No. 40 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Stillingia is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM STRAMONII SEMINIS FLUIDUM. *U.S.* **Fluid Extract of Stramonium Seed.**

[Extractum Stramonii Fluidum, Pharm. 1880.]

	Metric.	Old form.
Stramonium Seed, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 200 C.c. [old form 9½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Stramonium Seed is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM TARAXACI FLUIDUM. *U.S.* Fluid Extract of Taraxacum.

	Metric.	Old form.
Taraxacum, in No. 80 powder	1000 Gm.	50 oz. av.
Diluted Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Taraxacum is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate; distil off the Alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM TRITICI FLUIDUM. *U.S.* Fluid Extract of Triticum.

	Metric.	Old form.
Triticum, finely cut	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Pack the Triticum in a cylindrical percolator, pour Boiling Water upon it, and allow the percolation to proceed, supplying boiling water, as required, until the Triticum is exhausted. Evaporate the percolate to 750 C.c. [old form 36 fl. oz.], and, having added to it 250 C.c. [old form 12 fl. oz.] of Alcohol, mix well and set it aside for forty-eight hours. Then filter the liquid and add to the filtrate enough of a mixture of Alcohol and Water made in the proportion of 1 volume of

Alcohol to 3 volumes of Water to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM UVÆ URSI FLUIDUM. *U.S.* **Fluid Extract of Uva Ursi.**

	Metric.	Old form.
Uva Ursi, in No. 30 powder	1000 Gm.	50 oz. av.
Glycerin	300 C.c.	14½ fl. oz.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix the Glycerin with 200 C.c. [old form 9½ fl. oz.] of Alcohol and 500 C.c. [old form 24 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 19 fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards a mixture of Alcohol and Water, made in the proportion of 200 C.c. [old form 10 fl. oz.] of Alcohol to 500 C.c. [old form 24 fl. oz.] of Water, until the Uva Ursi is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough of the mixture of Alcohol and Water to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM VALERIANÆ FLUIDUM. *U.S.* **Fluid Extract of Valerian.**

	Metric.	Old form.
Valerian, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	3 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Valerian is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM VERATRI VIRIDIS FLUIDUM. *U. S.* **Fluid Extract of Veratrum Viride.**

	Metric.	Old form.
Veratrum Viride, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 300 C.c. [old form 14½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Veratrum Viride is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM VIBURNI OPULI FLUIDUM. *U. S.* **Fluid Extract of Viburnum Opulus.**

	Metric.	Old form.
Viburnum Opulus, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 14½ fl. oz.] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Viburnum Opulus is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM VIBURNI PRUNIFOLII FLUIDUM. *U. S.* **Fluid Extract of Viburnum Prunifolium.**

	Metric.	Old form.
Viburnum Prunifolium, in No. 60 powder	1000 Gm.	50 oz. av.
Alcohol,		
Water, each, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Mix 750 C.c. [old form 36 fl. oz.] of Alcohol with 250 C.c. [old form 12 fl. oz.] of Water, and, having moistened the powder with 300

C.c. [old form 14½ fl. oz.] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Viburnum Prunifolium is exhausted. Reserve the first 850 C.c. [old form 41 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM XANTHOXYLI FLUIDUM. *U. S.* **Fluid Extract of Xanthoxylum.**

	Metric.	Old form.
Xanthoxylum, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 250 C.c. [old form 12 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Xanthoxylum is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

EXTRACTUM ZINGIBERIS FLUIDUM. *U. S.* **Fluid Extract of Ginger.**

	Metric.	Old form.
Ginger, in No. 40 powder	1000 Gm.	50 oz. av.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	8 pints.

Moisten the powder with 250 C.c. [old form 12 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Ginger is exhausted. Reserve the first 900 C.c. [old form 43 fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluid Extract measure 1000 C.c. [old form 3 pints].

QUESTIONS ON CHAPTER XXVII.

ALCOHOLIC LIQUIDS MADE BY PERCOLATION OR MACERATION.

What are tinctures? How many are official?

Wherein do they differ from spirits?

What exception is there to this rule?

By what different methods are tinctures made?

What menstrua are used in making tinctures?

What are the advantages, and what the disadvantages, of using alcohol as a menstruum?

Where the alcohol is objectionable, what other preparation may be substituted for a tincture?

Which will extract a larger amount of the soluble principles of a drug, a pint of diluted alcohol or half a pint of alcohol and half a pint of water, used separately?

Name some of the principal substances that are soluble in alcohol.

What substances are soluble in diluted alcohol?

For what purpose is glycerin used in tinctures?

In what different ways are official tinctures made?

Which is the best method for making tinctures?

What are the special advantages of percolation?

Which will be found more convenient in practice, the use of measures or the use of parts by weight in making tinctures?

How many official tinctures are made by percolation?

In what cases is the process of maceration preferably used?

What tincture is made by simple solution?

What official tincture is made by dilution?

Give the formula and mode of making tincture of aconite.

What part of the plant is meant by aconite?

What fineness of powder is used in this formula?

Give the official name, formula, and mode of making tincture of aloes. Tincture of aloes and myrrh. Tincture of arnica flowers.

The name of this preparation in the U. S. P. of 1870 was tincture of arnica. Why was it changed?

Give the official name, formula, and mode of making tincture of arnica root. Tincture of asafetida. Tincture of bitter orange peel. Tincture of sweet orange peel. Tincture of belladonna leaves. What was the name of this preparation in the Pharmacopœia of 1880? Tincture of benzoin. Compound tincture of benzoin. Tincture of bryonia. Tincture of calendula. Tincture of calumba. Tincture of Indian cannabis. Tincture of cantharides. Tincture of capsicum. Tincture of cardamom. Compound tincture of cardamom. Compound tincture of catechu. Tincture of chirata. Tincture of cimicifuga. Tincture of cinchona.

What kind of cinchona is used in this tincture?

Give the formula and mode of making compound tincture of cinchona.

What kind of cinchona is used in this tincture?

What degree of fineness is directed for the powder?

Give the formula and mode of making tincture of cinnamon. Tincture of colchicum seed. What was the name of this preparation in the U. S. P. of 1880? Tincture of saffron. Tincture of cubeb. Tincture of digitalis.

How should tinctures of fresh herbs be made when no special direction has been given?

Give the formula for tincture of ferric chloride.

What salt of iron does it contain?

Describe its appearance and properties.

What is its specific gravity?

Give the formula and mode of making tincture of nutgall. Tincture of gelsemium. Compound tincture of gentian.

What degree of fineness is directed for the powder?

Give the formula and mode of making tincture of guaiac. Ammoniated tincture of guaiac. What degree of fineness is directed for the powder in these last two tinctures? Tincture of hops. Tincture of hydrastis. Tincture of hyoscyamus.

Give the formula and mode of making tincture of iodine.

How does the present name (Latin) differ from that of the U. S. P. 1870?
Give the formula for making tincture of ipecac and opium.
Give the formula and mode of making tincture of kino. Tincture of krameria. Tincture of lactucarium. Compound tincture of lavender.
What degree of fineness is directed for the powder?
Give the formula and mode of making tincture of lobelia.
What part of the plant is meant by lobelia?
Give the formula and mode of making tincture of matico. Tincture of musk. Tincture of myrrh. Tincture of nux vomica.
How much dry extract of nux vomica does each 100 parts of tincture contain?
What percentage of alkaloids should extract of nux vomica contain?
What quantity of alkaloids should be contained in 100 C.c. of the tincture?
How is tincture of opium made?
How much opium is there in each 100 parts of tincture?
About how much is there in a teaspoonful of tincture?
Give the formula and mode of making camphorated tincture of opium.
How much opium is there in each 100 parts of this tincture?
How is deodorized tincture of opium made?
How much opium is there in each 100 parts of tincture?
Give the formula and mode of making tincture of physostigma. Tincture of pyrethrum. Tincture of quassia. Tincture of quillaja. Tincture of rhubarb. Aromatic tincture of rhubarb. Sweet tincture of rhubarb. Tincture of sanguinaria. Tincture of squill. Tincture of serpentaria. Tincture of stramonium seed. Tincture of sumbul. Tincture of tolu. Tincture of valerian. Ammoniated tincture of valerian. Tincture of vanilla. Tincture of veratrum viride. Tincture of ginger.
What are medicated wines?
Which are preferable preparations, wines or tinctures? and why?
How many official wines are there?
In how many different ways are official wines prepared?
Which are not medicated?
How many are made by solution? Name them.
Name those made by maceration. By percolation.
How are they made?
What is white wine?
What percentage of alcohol should it contain?
What is red wine? How much alcohol should it contain?
What wine is used in making the official wines?
Give the formula and mode of making wine of antimony.
What percentage of tartrate does it contain?
About how much in a teaspoonful?
Give the formula and mode of making wine of colchicum root. Wine of colchicum seed. Wine of ergot. Bitter wine of iron. Wine of citrate of iron. Wine of ipecac. Wine of opium.
How much opium is there in 100 parts of the wine?
Give the formula and mode of making wine of rhubarb.
What are fluid extracts?
When were they made official in the U. S. P. for the first time?
How many are there in the present Pharmacopœia?
What are the special advantages of fluid extracts?
How is permanency secured?
What is the advantage of concentration?
Are the fluid extracts of the present Pharmacopœia of the same strength as those of the U. S. P. 1870?
What difference is there between them?
Are they different from those of the U. S. P. 1880?
Upon what is the present system arranged?
In what different methods are fluid extracts made?
What is the official process?
Give a typical formula for preparing a fluid extract.
Explain the process of percolation with incomplete exhaustion in making fluid extracts.
What is the principal disadvantage of this process, and why is the official process better?
Give a description of the process of repercolation. Of repercolation with hydraulic pressure. Of vacuum maceration and percolation.

How may fluid extracts be best preserved?

Into how many classes are fluid extracts divided?

How many have for a menstruum alcohol? Name them. Why is alcohol used for these in preference to other menstruums?

How many have for a menstruum 4 parts alcohol, 1 part water?

How many have for a menstruum 8 parts alcohol, 1 part water? Name them. How many have acetic acid in addition to this menstruum? Name them. What fluid extract has ammonia, how much ammonia is used, and why is ammonia used?

How many have for a menstruum 2 parts alcohol, 1 part water? Name them. How many have glycerin in addition to this menstruum, and how much glycerin is used? Name them.

How many have for a menstruum diluted alcohol? Name them.

How many have glycerin in addition to this menstruum? Name them. How much glycerin have they? Have they all the same amount of glycerin? How many have a menstruum of diluted alcohol together with acetic acid? How much acetic acid is used, and for what purpose?

How many have for a menstruum 1 part alcohol, 2 parts water? Name them. Which one has this same menstruum with the addition of glycerin?

Give the menstrua for the following fluid extracts: apocynum, bitter orange peel, cinchona, frangula, glycyrrhiza, gossypium, hamamelis, pareira, uva ursi, wild cherry.

What two have for a menstruum boiling water?

Which official fluid extract is made with ammonia water in the menstruum?

What is the object of using ammonia water?

CHAPTER XXVIII.

ETHEREAL LIQUIDS MADE BY PERCOLATION.

Oleoresinæ. *Oleoresins.*

THE oleoresins are official liquid preparations, consisting principally of natural oils and resins extracted from vegetable substances by percolation with ethylic ether. The oleoresins were formerly classed with fluid extracts, but they differ essentially from the latter: 1. They do not bear any uniform relation to the drug, as the fluid extracts do, of gramme to cubic centimetre,—the yield of oleoresin obtained from the drug varying according to the proportion of oil and resin naturally present. 2. The menstruum used, ethylic ether, extracts principles which are often insoluble in alcohol or in diluted alcohol, and *vice versa.* Oleoresin of cubeb, for instance, is not identical in properties with fluid extract of cubeb. 3. They are without exception the most concentrated liquid preparations of the drugs that are produced.

FIG. 347.

Percolator for volatile liquids.

Oleoresins are prepared by percolating the powdered drug, contained in a cylindrical percolator provided with a cover and receptacle suitable for volatile liquids, with ethylic ether, until exhausted, recovering the greater part of the ether by distillation, and exposing the residue in a capsule to spontaneous evaporation until the remaining ether has evaporated. Fig. 347 shows a convenient percolator for making oleoresins. The powder should not be packed too tightly in the narrow percolator: the exit-tube affords a means of easily regulating the flow. A *continuous extraction apparatus* can be made of this percolator by enclosing the upper part in a suitable case and passing cold water between, arranging the apparatus like a Liebig's condenser (see page 157). A glass tube is connected with the top of the percolator and the mouth of the bottle by rubber-tube connections, and if the receiving-bottle is placed in a water-bath and the water gently heated, the ether will evaporate from the percolate, the vapors rising in the tube and condensing in the upper part of the percolator.

Oleoresins which have not been evaporated sufficiently are frequently found in commerce: they have a decided odor of ether, and sometimes of benzin, showing in the latter case that a menstruum which is a much inferior solvent has been substituted for the one authorized by the Pharmacopœia. *Six* oleoresins are official.

Table of Official Oleoresins.

Name.	Yield.	Dose.
Oleoresina Aspidii.	10 to 15 per cent.	f℥ss to f℥i.
" Capsici.	5 per cent.	♏¼ to ♏i.
" Cubebæ.	18 to 25 per cent.	♏v to ♏xxx.
" Lupulini.	50 per cent.	♏ij to ♏v.
" Piperis.	5 per cent.	♏¼ to ♏i.
" Zingiberis.	6 to 8 per cent.	♏i.

OLEORESINA ASPIDII. *U. S.* Oleoresin of Aspidium.

	Metric.	Old form.
Aspidium, recently reduced to No. 60 powder	500 Gm.	16 oz. av.
Ether, a sufficient quantity.		

Put the Aspidium into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining Ether to evaporate spontaneously. (The product is usually about 60 Gm.) [old form 2 fl. oz.].

Keep the oleoresin in a well-stoppered bottle.

NOTE.—Oleoresin of Aspidium usually deposits, on standing, a granular-crystalline substance (filicic acid). This should be thoroughly mixed with the liquid portion before use.

OLEORESINA CAPSICI. *U. S.* Oleoresin of Capsicum.

	Metric.	Old form.
Capsicum, in No. 60 powder	500 Gm.	32 oz. av.
Ether, a sufficient quantity.		

Put the Capsicum into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining Ether to evaporate spontaneously. Then pour off the liquid portion, transfer the remainder to a strainer, and, when the separated fatty matter (which is to be rejected) has been completely drained, mix the liquid portions together. (The product is usually about 25 Gm.) [old form 1½ fl. oz.].

Keep the Oleoresin in a well-stoppered bottle.

OLEORESINA CUBEBÆ. *U. S.* Oleoresin of Cubeb.

	Metric.	Old form.
Cubeb, in No. 30 powder	500 Gm.	16 oz. av.
Ether, a sufficient quantity.		

Put the Cubeb into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath,

and, having transferred the residue to a capsule, allow the remaining Ether to evaporate spontaneously. (The product is usually about 125 Gm.) [old form 4 fl. oz.].

Keep the product in a well-stoppered bottle.

NOTE.—Oleoresin of Cubeb deposits, after standing for some time, a waxy and crystalline matter (Cubebin), which should be rejected, only the liquid portion being used.

OLEORESINA LUPULINI. *U. S.* Oleoresin of Lupulin.

	Metric.	Old form.
Lupulin	100 Gm.	16 oz. av.
Ether, a sufficient quantity.		

Put the Lupulin into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug very lightly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining Ether to evaporate spontaneously. (The product is usually about 50 Gm.) [old form 8 fl. oz.].

Keep the Oleoresin in a well-stoppered bottle.

OLEORESINA PIPERIS. *U. S.* Oleoresin of Pepper.

	Metric.	Old form.
Pepper, in No. 60 powder	500 Gm.	32 oz. av.
Ether, a sufficient quantity.		

Put the Pepper into a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and receptacle for volatile liquids. Press the drug firmly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, set this aside until the remaining Ether has evaporated, and the deposition of crystals of piperin has ceased. Lastly, separate the Oleoresin from the piperin by expression through a muslin strainer. (The product is usually about 25 Gm.) [old form 1½ fl. oz.].

Keep the Oleoresin in a well-stoppered bottle.

OLEORESINA ZINGIBERIS. *U. S.* Oleoresin of Ginger.

	Metric.	Old form.
Ginger, in No. 60 powder	500 Gm.	16 oz. av.
Ether, a sufficient quantity.		

Put the Ginger into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with Ether, added in successive portions, until the drug is exhausted. Recover the greater part of the Ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining Ether to evaporate spontaneously. (The product is usually about 30 Gm.) [old form 1 fl. oz.].

Keep the Oleoresin in a well-stoppered bottle.

CHAPTER XXIX.

ACETOUS LIQUIDS MADE BY PERCOLATION.

Aceta. *Vinegars.*

THIS class of preparations is an old one, having been in use since the days of Hippocrates. Medicated vinegars are solutions of the active principles of drugs in diluted acetic acid, the latter being chosen as a menstruum because acetic acid is not only a good solvent but also possesses antiseptic properties.

Diluted acetic acid replaces the menstrua formerly used, wine and cider vinegar having been discarded on account of their variable quality. Acetic acid may be obtained in all parts of the country very cheaply and of unexceptionable quality, and by simple admixture with about five times its weight of water the menstruum is produced. The properties of acetic acid are noticed in Part IV. of this work.

Two vinegars are official at present: one is made from a drug which owes its activity to alkaloids. The advantage of using acidulous menstruum is apparent in forming soluble salts with the alkaloids, and experience has proved the value of diluted acetic acid as a solvent in exhausting drugs of this character. The medicated vinegars should not be made in larger quantities than can be used within a reasonable time, for, although possessed of most of the characters of permanent preparations, they are liable to deposit in time.

The official vinegars are now uniform in strength, each containing the soluble principles from ten per cent. of drug. They are both made by percolation.

Table of Official Vinegars.

Name.	Proportions.
Acetum Opii	100 Gm. Powdered Opium; 80 Gm. Powdered Nutmeg; 200 Gm. Sugar, with sufficient Diluted Acetic Acid to make 1000 C.c.
" Scillæ	100 Gm. Squill, No. 30 powder, with sufficient Diluted Acetic Acid to make 1000 C.c.

ACETUM OPII. *U.S.* Vinegar of Opium.

	Metric.	Old form.
Powdered Opium	100 Gm.	365 grains.
Nutmeg, in No. 30 powder	30 Gm.	109 grains.
Sugar	200 Gm.	730 grains.
Diluted Acetic Acid, a sufficient quantity,		
To make	1000 C.c.	½ pint.

Macerate the Opium and Nutmeg in 500 C.c. [old form 4 fl. oz.] of Diluted Acetic Acid during seven days, frequently stirring; then

strain through muslin of close texture, and express the liquid. Mix the residue with 200 C.c. [old form 1½ fl. oz.] of Diluted Acetic Acid to a uniform magma, and strain and express again. Mix and filter the strained liquids, dissolve the Sugar in the filtrate, and pass enough Diluted Acetic Acid through the filter to make the product measure 1000 C.c. [old form 8 fl. oz.].

To assay this preparation, transfer 100 C.c. of it to a small capsule, add 4 Gm. of precipitated calcium carbonate, or such a quantity as will be sufficient to neutralize the free acid, and then proceed further as directed under *Tinctura Opii.*

ACETUM SCILLÆ. *U. S.* **Vinegar of Squill.**

	Metric.	Old form.
Squill, in No. 30 powder	100 Gm.	3 oz. av. 148 gr.
Diluted Acetic Acid, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Macerate the Squill with 900 C.c. [old form 29 fl. oz.] of Diluted Acetic Acid during seven days, frequently stirring; then strain through muslin, and wash the mass on the strainer with enough Diluted Acetic Acid, until the strained liquid measures 1000 C.c. [old form 2 pints]. Finally filter.

QUESTIONS ON CHAPTERS XXVIII. AND XXIX.

ETHEREAL AND ACETOUS LIQUIDS MADE BY PERCOLATION.

What are oleoresins?
In what respects do they differ from fluid extracts?
How are they prepared?
How many oleoresins are official? Name them.
Give the official name, menstruum, and mode of preparing oleoresin of aspidium.
Should the deposit which usually occurs in this oleoresin upon standing be filtered out?
Give the Latin name, menstruum, and mode of preparing oleoresin of capsicum. Oleoresin of cubeb.
Should the waxy and crystalline matter which is deposited from oleoresin of cubeb be separated from the oleoresin?
Give the Latin name, menstruum, and mode of preparing oleoresin of lupulin. Oleoresin of pepper.
Should the latter oleoresin be separated from the piperin which is deposited?
Give the Latin name, menstruum, and mode of preparing oleoresin of ginger.
What are medicated vinegars?
Why was vinegar chosen as a menstruum, and why is acetic acid used in place of vinegar?
How many vinegars are official? Name them.
What is their percentage strength?
How are they made?
Give the Latin name and menstruum of vinegar of opium. Vinegar of squill.
What are the ingredients of acetum opii, and in what condition of fineness are they directed?

CHAPTER XXX.

SOLID PREPARATIONS MADE BY PERCOLATION.

Extracta. *Extracts.*

Extracts are solid or semi-solid preparations produced by evaporating solutions of vegetable principles. The solutions may be made by percolating the drug with water, alcohol, diluted alcohol of various strengths, ether, diluted acetic acid, or diluted solution of ammonia, and the extracts made from such percolates are termed respectively *aqueous*, *alcoholic*, *hydro-alcoholic*, *ethereal*, *acetic*, or *ammoniated* extracts. In addition to this, the juices of fresh plants extracted by contusion and expression are evaporated, and such extracts are frequently called *Succi Spissati*, or *inspissated juices*.

Preparation of Inspissated Juices.—The variation in the amount of extractive matter afforded by expressing fresh plants is so great that the quality of this class of extracts is necessarily very uncertain. Although alcoholic extracts are also subject to variations, experience has shown that they are much more reliable, when properly made, than extracts prepared from expressed juices. For this reason inspissated juices, with one exception, were not recognized in the U.S. Pharmacopœia of 1890. Extract of taraxacum, the sole representative of the class remaining, is at best a feeble preparation, and is fast passing out of use as an active remedy. The inspissated juices most largely consumed in America are made in Great Britain, and the general formula of the British Pharmacopœia is appended:

Bruise the fresh plant in a stone mortar, and press out the juice; heat it gradually to 130° F., and separate the green colouring matter by a calico filter. Heat the strained liquid to 200° F. to coagulate the albumen, and filter again. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole assiduously, continue the evaporation at a temperature not exceeding 140° F., until the extract is of a suitable consistence for forming pills.

Prof. Herrara has proposed a plan of making extracts without the use of much heat,—*by freezing the juices.* He finds that by compressing the frozen juice the expressed liquid, or mother-liquor, is greatly strengthened, the water being largely removed as ice, which remains in the press-cloth, and the concentrated juice is then dried by exposure on plates to the sun.

The percolates, or expressed juices of drugs, contain, in addition to the active principles, certain inert substances, which exist in the liquids in varying quantities. The amount of inert matter found in the extract

depends largely upon the manipulation, but the composition of extracts also varies with the nature of the drug, the character of the solvent, and the mode of preparation. The object is generally to obtain as much of the active principle of the plant, with as little of the inert matter, as possible; though sometimes it may be desirable to separate two active ingredients from each other, when their effects upon the system are materially different: this may be partially accomplished by employing a menstruum which, while it dissolves one, leaves the other untouched. The proximate principles most commonly present in extracts are *gum*, *sugar*, *starch*, *tannin*, *extractive*, *chlorophyl*, *coloring-matter*, *salts*, and the *peculiar principles of plants;* to which, when a spirituous solvent is employed, may usually be added *resinous substances*, *fatty matter*, and frequently more or less *volatile* oil; gum and starch being excluded when the menstruum is pure alcohol.

Extractive.—It has long been known that in most vegetable bodies there is a substance, soluble both in water and in alcohol, which, in the preparation of extracts, undergoes chemical change during the process of evaporation, imparting to the liquid, even if originally limpid, first a greenish, then a yellowish-brown, and ultimately a deep brown color, and becoming itself insoluble. This substance has received the appropriate name of *extractive*, derived from its frequent presence in extracts. Its existence as a distinct principle is denied, or at least doubted, by some chemists, who consider the phenomena supposed to result from its presence as depending upon the mutual reaction of other principles. The most important property of extractive is its disposition to pass, by the influence of atmospheric air at a high temperature, into an insoluble substance. If a vegetable infusion or decoction be evaporated in the open air to the consistence of an extract, then diluted, filtered, and again evaporated, and the process repeated so long as any insoluble matter is formed, the whole of the extractive will be separated from the liquid, while the other ingredients may remain. If chlorine be passed through an infusion or decoction, a similar precipitate is formed with much greater rapidity. The change is usually ascribed to the absorption of oxygen by the extractive, which has, therefore, been called, in its altered condition, oxidized extractive; but De Saussure ascertained that, though oxygen is absorbed during the process, an equal measure of carbonic acid gas is given out, and the oxygen and hydrogen of the extractive unite to form water in such a manner as to leave the principle richer in carbon than it was originally. The name of oxidized extractive is, therefore, obviously incorrect; and Berzelius long ago proposed to substitute for it that of *apotheme*, synonymous with deposit. According to Berzelius, apotheme is not completely insoluble in water, but imparts a slight color to that liquid when cold, and is rather more soluble in boiling water, which becomes turbid upon cooling. It is still more soluble in alcohol, and is freely dissolved by solutions of the alkalies and alkaline carbonates, from which it is precipitated by acids. It has a great tendency, when precipitated from solutions, to unite with other principles and to carry them along with it, thus acquiring properties somewhat different according to the source from which it is obtained. In this way, also, even when the extractive of a plant is itself medicinally

inert, its conversion into apotheme may be injurious by causing a precipitation of a portion of the active principle; and in practical pharmaceutical operations this change should always, if possible, be avoided.

Variable Quality of Extracts.—*It is evident that there must be great variation in the quality of these preparations as found in commerce*, for, whether made by any of the processes commonly employed, or by a special patented process, the lack of a fixed standard to determine the amount of moisture which is to remain in the extracts renders them very variable in strength. The Pharmacopœia is necessarily compelled to avoid specifying an exact limit in this respect, and the approximate standard of "*pilular consistence*" has been adopted. The preparations considered in another place, called *abstracts*, have a great advantage over extracts in this respect. It should be said in addition that the variation in the strength of extracts of pilular consistence does not cease even after their manufacture. The exposure to the air which they are subject to in dispensing, particularly if kept in the customary open queen's-ware jars, causes loss of moisture, and they become hard, and consequently stronger, in proportion to the quantity of moisture that is thus lost: this loss may in some cases amount to as much as twenty-five per cent. In moist climates, however, some extracts absorb moisture and become thinner. The greatest variation in the commercial extracts, however, arises from the difference in the alcoholic strength of the menstruum employed. This may be best illustrated by taking the case of extract of jalap. Alcohol always dissolves the active principles, whilst water is the best solvent for those that are inert. If a manufacturer in making extract of jalap uses equal parts of alcohol and water, he will obtain twice as much extract as the manufacturer who simply uses alcohol; but the alcoholic extract or resin has twice the strength of the hydro-alcoholic extract, and is worth double the price, because it has been shown by actual experiment that the aqueous extract of jalap is absolutely inert even in doses of two hundred and forty grains. The difference between the relative merits of alcoholic and aqueous extracts does not so clearly appear in many of the extracts as in the instance just noted, but it is shown in such important extracts as those from belladonna, hyoscyamus, digitalis, etc., for here the strength depends largely upon the menstrua used in exhausting them, water removing the inert principles, starch, gum, albumen, sugar, salt, etc. The relative value of commercial extracts must depend upon the amount of *active* principles present; and as the manufacturer never states upon the label the menstruum that he has employed in making the extract, nor the yield of the extract from the drug from which it was prepared, and as each manufacturer uses the menstruum that he thinks best, the pharmacist and physician have no means of knowing the dose of the extract, nor can they usually form any correct judgment of its value without a therapeutical experiment or analytical assay. It will be seen, therefore, from the foregoing considerations that extracts are among the most *unreliable* of all classes of preparations. It is greatly to be regretted that manufacturers do not *strictly adhere* to the menstrua directed in the Pharmacopœia, for the sake of securing uniformity, if for no other reason.

Preparation of Extracts.—The manipulations necessary to produce

extracts have all been treated of under the various heads of Maceration, Expression, Percolation, Decoction, Infusion, Evaporation, Use of Steam Heat, Vacuum Apparatus, etc. The special precautions necessary for each extract will be noticed in the official working formulas which follow. The details of the formulas vary so much that a general formula is of little value, except to serve as a type for the alcoholic extracts, which resemble one another more closely than any of the others do.

Preservation of Extracts.—The general practice is to take no especial care in the preservation of extracts. This arises from the incorrect impression that they are permanent preparations and do not need it. The manufacturers seal the jars or bottles which contain them, because experience has compelled them to be very careful about this, to avoid loss in transportation,—in the case of soft extracts, through inversion of the jar. The loosely-fitting covers to the jars permit the exposure which causes the variation above noticed, and it is impracticable for the pharmacist on every occasion to seal the jar immediately after he has used a portion of the extract. Several expedients have been suggested to overcome these difficulties. It is a good practice to enclose the jar in a tightly-fitting tin can, or to put the extract in a jar with a screw-cap cover which has a thin cork disk in the top to aid in making a tight joint.

General Formula for Alcoholic Extracts.—Percolate the powdered drug with the menstruum directed, until it is exhausted; reserve the first third of the percolate, evaporate the remainder at a temperature not exceeding 50° C. (122° F.) until it weighs ten per cent. of the weight of the drug. Mix this with the reserved portion, and evaporate both at the above temperature to a pilular consistence. Or, instead of reserving a part of the percolate, the whole quantity is distilled until the alcohol is recovered, and the residue is evaporated to a pilular consistence. In the case of those extracts which are apt to become hard, five per cent. of glycerin may be added to enable them to retain their consistence.

Official Extracts.—The official extracts are *thirty-three* in number. Of these, *twenty-three* are directed to be made with alcoholic menstrua of various strengths,—viz., Extracts of Aconite, Jalap, Physostigma, Cannabis Indica, Cimicifuga, Iris, Podophyllum, Rhubarb, Cinchona, Leptandra, Nux Vomica, Belladonna Leaves, Hyoscyamus, Digitalis, Euonymus, Arnica Root, Conium, Juglans, Stramonium (seed), Colocynth, Ergot, Uva Ursi, Compound Colocynth.

Ten official extracts are made with an aqueous menstruum,—viz., Extract of Aloes, Hæmatoxylon, Opium, Taraxacum, Gentian, Pure Extract of Glycyrrhiza, Krameria, Quassia, Colchicum Root, Glycyrrhiza. Of these,

One extract is percolated with water containing five per cent. of ammonia water,—*i.e.*, Pure Extract of Glycyrrhiza.

One extract is made with a menstruum composed of water containing 23.3 per cent. of official acetic acid,—*i.e.*, Extract of Colchicum Root.

One extract is made by evaporating a fluid extract,—*i.e.*, Extract of Ergot. *One* extract is made by mixing extracts with aromatics, etc., —*i.e.*, Compound Extract of Colocynth.

One extract is an inspissated juice,—*i.e.*, Extract of Taraxacum.

Table of Official Extracts arranged according to the Alcoholic Strength of their Menstrua.

Name and Menstruum.	Fineness of Powder.	Quantity to moisten 1000 Gm. of Drug.	Per cent. reserved.	Process and Notes.
Alcohol.		C.c.		
Extractum Aconiti.	60	400	90	Percolating after 48 hours' maceration, reserving 90 per cent. of percolate, evaporating the remainder to 10 per cent., adding the reserved portion, and evaporating at a temperature not above 50° C. (122° F.) to a pilular consistence.
Jalapæ.	60	850	90	" " " "
Physostigmatis.	80	400	90	" " " "
Cannabis Indicæ.	20	800		Percolating to exhaustion after 48 hours' maceration, distilling off alcohol, and evaporating to a pilular consistence.
Cimicifugæ.	60	250		" " " "
Iridis.	60	400		" " " "
Alcohol 4, Water 1.				
Extractum Podophylli.	60	800		" " " "
Rhei.	80	400	100	Percolating to exhaustion after maceration, reserving the first 1000 C.c. of percolate from 1000 Gm. of drug, and spontaneously evaporating this reserved portion to one-half its weight, evaporating the remainder to the consistence of syrup, mixing with reserved portion, and evaporating to a pilular consistence.
Alcohol 3, Water 1.				
Extractum Cinchonæ.	60	850		Percolating to exhaustion after 48 hours' maceration, using diluted alcohol to finish, distilling off alcohol, and evaporating to a pilular consistence.
Leptandræ.	40	400		Percolating to exhaustion after 48 hours' maceration, distilling off alcohol, and evaporating te a pilular consistence.
Nucis Vomicæ.	60	1000		Percolating to exhaustion after *digestion* for 48 hours (5 per cent. acetic acid in menstruum), evaporating to a thick liquid, assaying, and adding sugar of milk till brought to the strength of "15 per cent. of alkaloids."
Alcohol 2, Water 1.				
Extractum Belladonnæ Alcoholicum (leaves).	60	400	90	Percolating to exhaustion after 48 hours' maceration, using diluted alcohol to finish, reserving 90 per cent. of percolate, evaporating the remainder to 10 per cent., mixing with reserved portion, and evaporating at a temperature not above 50° C. (122° F.) to a pilular consistence.
Hyoscyami.	60	400	90	" " " "

Official Extracts.—(*Continued.*)

Name and Menstruum.	Fineness of Powder.	Quantity to moisten 1000 Gm. of Drug.	Per cent. reserved.	Process and Notes.
Alcohol 2, Water 1.		C.c.		
Extractum Digitalis.	60	400		Percolating to exhaustion after 48 hours' maceration, using diluted alcohol to finish, distilling off alcohol, and evaporating at a temperature not exceeding 50° C. (122° F.) to a pilular consistence.
Euonymi.	80	400		" " " "
Diluted Alcohol.				
Extractum Arnicæ Radicis.	60	400	90	Percolating to exhaustion after 24 hours' maceration, reserving 90 per cent. of percolate, evaporating the remainder to 10 per cent., mixing with reserved portion, and evaporating at a temperature not above 50° C. (122° F.) to a pilular consistence.
Conii.	40	300	90	Same process as for Arnica Root, except the time of maceration, which is 48 hours, and with the addition of 2 per cent. of acetic acid to the diluted alcohol.
Juglandis.	30	400		Percolating to exhaustion after 48 hours' maceration, distilling off alcohol, and evaporating to a pilular consistence.
Stramonii Seminis.	60	300	90	Percolating to exhaustion after 48 hours' maceration, reserving 90 per cent. of percolate, evaporating the remainder to 10 per cent., mixing with reserved portion, and evaporating at a temperature not above 50° C. (122° F.) to a pilular consistence.
Colocynthidis (freed from seeds).	Coarse powder.			Macerating for 4 days, expressing and straining tincture through flannel, percolating residue, distilling the mixed tinctures to recover the alcohol, evaporating residue to dryness, and making into a *powdered extract.*
Ergotæ.				Made by evaporating Fluid Extract of Ergot at a temperature not exceeding 50° C. (122° F.) to a pilular consistence.
Alcohol 2, Water 5.				
Extractum Uvæ Ursi.	30	400	90	Percolating to exhaustion after 48 hours' maceration, reserving 90 per cent. of the percolate, evaporating the remainder to 10 per cent., mixing, and evaporating to a pilular consistence.
Water.				
Extractum Aloes.				Maceration. *Macerating* in boiling water, with stirring, letting the mixture stand for 12 hours, decanting the liquid, and evaporating to dryness.
Hæmatoxyli.				Maceration. *Macerating* with cold water for 48 hours, then boiling (avoiding the use of metallic vessels) until one-half the water has evaporated, straining the decoction while hot, and evaporating to dryness.

Official Extracts.—(*Continued.*)

Name and Menstruum.	Fineness of Powder.	Quantity to moisten 1000 Gm. of Drug.	Per cent. reserved.	Process and Notes.
Water.		C.c.		
Extractum Opii.				Maceration. *Macerating* repeatedly in cold water, filtering, evaporating the mixed filtered liquids, assaying, and adding sufficient sugar of milk to make the dry powdered extract contain 18 per cent. of morphine.
Taraxaci.				Inspissated juice from the fresh plant.
Gentianæ.	20	400		Percolating to exhaustion after 24 hours' maceration, boiling the percolate until reduced to three-fourths of its weight, straining, and evaporating to a pilular consistence.
Glycyrrhizæ Purum.	20	1000		Percolating to exhaustion after 24 hours' maceration with water containing 5 *per cent. of Ammonia Water* to dissolve the Glycyrrhizin, and evaporating to a pilular consistence.
Krameriæ.	40	300		Percolating to exhaustion, heating the liquid to the boiling point, straining, and evaporating at a temperature not above 70° C. (158° F.) to dryness.
Quassiæ.	20	400		Percolating to exhaustion, reducing the liquid to three-fourths of its weight by boiling, straining, and evaporating to a pilular consistence.
Colchici Radicis.	60	500		Percolating to exhaustion after macerating with water containing 23.3 *per cent. of Official Acetic Acid*, and evaporating the percolate at a temperature not above 80° C. (176° F.) to a pilular consistence.
Glycyrrhizæ.				*Commercial extract* in rolls: not less than 60 per cent. of it should be soluble in cold water.
	Compound Extract.			
Colocynthidis Compositum.	Extract of Colocynth, 160 Gm. Purified Aloes, 500 Gm. Cardamom, No. 60 powder, 60 Gm. Resin of Scammony, in fine powder, 140 Gm. Soap, dried, and in coarse powder, 140 Gm. Alcohol, 100 C.c.			Melting the Aloes by heating, adding the Alcohol, adding the Soap, Extract of Colocynth, and Resin of Scammony, heating the mixture at a temperature not exceeding 120° C. (248° F.) until homogeneous, withdrawing the heat, and adding the Cardamom; when cold, *reducing the product to a fine powder.*

EXTRACTUM ACONITI. *U. S.* Extract of Aconite.

	Metric.	Old form.
Aconite, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Aconite is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.], add the reserved portion, and evaporate, at or below the above-mentioned temperature, until an extract of a pilular consistence remains.

EXTRACTUM ALOES. *U. S.* Extract of Aloes.

	Metric.	Old form.
Aloes	100 Gm.	82 oz. av.
Boiling Distilled Water	1000 C.c.	20 pints.

Mix the Aloes with the Water in a suitable vessel, stirring constantly, until the particles of Aloes are thoroughly disintegrated, and let the mixture stand for twelve hours; then pour off the clear liquor, strain the residue, mix the liquids, and evaporate to dryness by means of a water- or steam-bath.

EXTRACTUM ARNICÆ RADICIS. *U. S.* Extract of Arnica Root.

	Metric.	Old form.
Arnica Root, in No. 60 powder	1000 Gm.	82 oz. av.
Diluted Alcohol, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until the Arnica Root is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, evaporate the remainder to 100 C.c. [old form 3 fl. oz.], at a temperature not exceeding 50° C. (122° F.), mix the residue with the reserved portion, and evaporate, at or below the above-mentioned temperature, to a pilular consistence.

EXTRACTUM BELLADONNÆ FOLIORUM ALCOHOLICUM. *U. S.*
Alcoholic Extract of Belladonna Leaves.

[EXTRACTUM BELLADONNÆ ALCOHOLICUM, PHARM. 1880.]

	Metric.	Old form.
Belladonna Leaves, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 2000 C.c. [old form 4 pints] of Alcohol with 1000 C.c. [old form 2 pints] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Belladonna Leaves are exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.], mix the residue with the reserved portion, and evaporate, at or below the above-mentioned temperature, to a pilular consistence.

EXTRACTUM CANNABIS INDICÆ. *U. S.* **Extract of Indian Cannabis.**

	Metric.	Old form.
Indian Cannabis, in No. 20 powder	1000 Gm.	82 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 300 C.c. [old form 9½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cannabis is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, in a porcelain capsule, on a water-bath, to a pilular consistence.

EXTRACTUM CIMICIFUGÆ. *U. S.* **Extract of Cimicifuga.**

	Metric.	Old form.
Cimicifuga, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 250 C.c. [old form 8 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Cimicifuga is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM CINCHONÆ. *U. S.* **Extract of Cinchona.**

	Metric.	Old form.
Cinchona, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol	3000 C.c.	6 pints.
Water	1000 C.c.	2 pints.
Diluted Alcohol, a sufficient quantity.		

Mix the Alcohol and Water, and, having moistened the powder with 350 C.c. [old form 11 fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Diluted Alcohol, until 4000 C.c. [old form 8 pints] of tincture are obtained or the Cinchona is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM COLCHICI RADICIS. *U. S.* Extract of Colchicum Root.

	Metric.	Old form.
Colchicum Root, in No. 60 powder	1000 Gm.	82 oz. av.
Acetic Acid	350 C.c.	11 fl. oz.
Water, a sufficient quantity.		

Mix the Acetic Acid with 1500 C.c. [old form 3 pints] of Water, and, having moistened the powder with 500 C.c. [old form 1 pint] of the mixture, pack it moderately in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Water, until the Colchicum Root is exhausted. Evaporate the percolate in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 80° C. (176° F.), to a pilular consistence.

EXTRACTUM COLOCYNTHIDIS. *U. S.* Extract of Colocynth.

	Metric.	Old form.
Colocynth, dried, and freed from the seeds	1000 Gm.	82 oz. av.
Diluted Alcohol, a sufficient quantity.		

Reduce the Colocynth to a coarse powder by grinding or bruising, and macerate it in 3500 C.c. [old form 7 pints] of Diluted Alcohol for four days, with occasional stirring; then express strongly, and strain through flannel. Pack the residue, previously broken up with the hands, firmly in a cylindrical percolator, cover it with the strainer, and gradually pour Diluted Alcohol upon it until the tincture and expressed liquid, mixed together, measure 5000 C.c. [old form 10 pints]. Distil off the Alcohol from the mixture by means of a water-bath, evaporate the residue to dryness, and reduce the dry mass to powder.

Extract of Colocynth should be kept in well-stoppered bottles.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM. *U.S.* Compound Extract of Colocynth.

	Metric.	Old form.
Extract of Colocynth	160 Gm.	16 oz. av.
Purified Aloes	500 Gm.	50 oz. av.
Cardamom, in No. 60 powder	60 Gm.	6 oz. av.
Resin of Scammony, in fine powder	140 Gm.	14 oz. av.
Soap, dried and in coarse powder	140 Gm.	14 oz. av.
Alcohol	100 C.c.	12 fl. oz.

Heat the Aloes, contained in a suitable vessel, on a water-bath, until it is completely melted; then add the Alcohol, Soap, Extract of Colocynth, and Resin of Scammony, and heat the mixture at a temperature not exceeding 120° C. (248° F.), until it is perfectly homogeneous, and a thread taken from the mass becomes brittle when cool. Then withdraw the heat, thoroughly incorporate the Cardamom with the mixture, and cover the vessel until the contents are cold. Finally, reduce the product to a fine powder.

Compound Extract of Colocynth should be kept in well-stoppered bottles.

EXTRACTUM CONII. *U.S.* Extract of Conium.

	Metric.	Old form.
Conium, in No. 40 powder	1000 Gm.	32 oz. av.
Acetic Acid	20 C.c.	5 fl. dr.
Diluted Alcohol, a sufficient quantity.		

Mix the Acetic Acid with 980 C.c. [old form 31½ fl. oz.] of Diluted Alcohol, and, having moistened the powder with 300 C.c. [old form 9½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or until the Conium is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.], mix this with the reserved portion, and evaporate, at or below the above-mentioned temperature, to a pilular consistence.

EXTRACTUM DIGITALIS. *U.S.* Extract of Digitalis.

	Metric.	Old form.
Digitalis, in No. 60 powder	1000 Gm.	32 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 600 C.c. [old form 19 fl. oz.] of Alcohol with 300 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder

and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Digitalis is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, at a temperature not exceeding 50° C. (122° F.), to a pilular consistence.

EXTRACTUM ERGOTÆ. *U. S.* Extract of Ergot.

	Metric.	Old form.
Fluid Extract of Ergot	150 C.c.	5 fl. oz.

Evaporate the Fluid Extract of Ergot in a porcelain capsule, by means of a water-bath, at a temperature not exceeding 50° C. (122° F.), constantly stirring, until it is reduced to a pilular consistence. (The yield is about 30 Gm. [old form 1 oz. av.].

EXTRACTUM EUONYMI. *U. S.* Extract of Euonymus.

	Metric.	Old form.
Euonymus, in No. 30 powder	1000 Gm.	32 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 600 C.c. [old form 19 fl. oz.] of Alcohol with 300 C.c. [old form 9½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Euonymus is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and, having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence.

EXTRACTUM GENTIANÆ. *U. S.* Extract of Gentian.

	Metric.	Old form.
Gentian, in No. 20 powder	1000 Gm.	32 oz. av.
Water, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Water, and let it macerate for twenty-four hours; then pack it in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with the properties of the Gentian. Reduce the liquid to three-fourths of its bulk by boiling, and strain; then, by means of a water-bath, evaporate to a pilular consistence.

EXTRACTUM GLYCYRRHIZÆ. *U.S.* Extract of Glycyrrhiza.

[EXTRACT OF LIQUORICE.]

The commercial extract of the root of *Glycyrrhiza glabra* Linné (nat. ord. *Leguminosæ*).

In flattened, cylindrical rolls, from 15 to 18 Cm. long, and from 15 to 30 Mm. thick; of a glossy black color. It breaks with a sharp, conchoidal, shining fracture, and has a very sweet, peculiar taste. Not less than 60 per cent. of it should be soluble in cold water.

EXTRACTUM GLYCYRRHIZÆ PURUM. *U.S.* Pure Extract of Glycyrrhiza.

	Metric.	Old form.
Glycyrrhiza, in No. 20 powder	1000 Gm.	32 oz. av.
Ammonia Water	150 C.c.	$4\frac{1}{2}$ fl. oz.
Distilled Water, a sufficient quantity.		

Mix the Ammonia Water with 3000 C.c. [old form 6 pints] of Distilled Water, and, having moistened the powder with 1000 C.c. [old form 2 pints] of the menstruum, let it macerate for twenty-four hours. Then pack it moderately in a cylindrical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and then Distilled Water, until the Glycyrrhiza is exhausted. Lastly, evaporate the infusion, by means of a water-bath, to a pilular consistence.

EXTRACTUM HÆMATOXYLI. *U.S.* Extract of Hæmatoxylon.

	Metric.	Old form.
Hæmatoxylon, rasped	1000 Gm.	32 oz. av.
Water	10,000 C.c.	20 pints.

Macerate the Hæmatoxylon with the Water for forty-eight hours. Then boil (avoiding the use of metallic vessels) until one-half of the Water has evaporated; strain the decoction, while hot, and evaporate to dryness.

EXTRACTUM HYOSCYAMI. *U.S.* Extract of Hyoscyamus.

	Metric.	Old form.
Hyoscyamus, in No. 60 powder	1000 Gm.	32 oz. av.
Alcohol	2000 C.c.	4 pints.
Water	1000 C.c.	2 pints.
Diluted Alcohol, a sufficient quantity.		

Mix the Alcohol and Water, and, having moistened the powder with 400 C.c. [old form $12\frac{1}{2}$ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then Diluted Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Hyoscyamus is exhausted. Reserve

the first 900 C.c. [old form 28½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, to a pilular consistence.

EXTRACTUM IRIDIS. *U.S.* Extract of Iris.

	Metric.	Old form.
Iris, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Iris is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM JALAPÆ. *U.S.* Extract of Jalap.

	Metric.	Old form.
Jalap, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 350 C.c. [old form 11 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the Jalap is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate. Distil off the Alcohol from the remainder by means of a water-bath, evaporate the residue to 100 C.c. [old form 3 fl. oz.], add the reserved portion, and evaporate to a pilular consistence.

EXTRACTUM JUGLANDIS. *U.S.* Extract of Juglans.

	Metric.	Old form.
Juglans, in No. 30 powder	1000 Gm.	82 oz. av.
Diluted Alcohol, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Juglans is exhausted. Distil off the

Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM KRAMERIÆ. *U.S.* Extract of Krameria.

	Metric.	Old form.
Krameria, in No. 40 powder	1000 Gm.	82 oz. av.
Water, a sufficient quantity.		

Moisten the powder with 300 C.c. [old form 9½ fl. oz.] of Water, pack it in a conical glass percolator, and gradually pour Water upon it, until the infusion passes but slightly imbued with the astringency of the Krameria. Heat the liquid to the boiling point, strain, and evaporate the strained liquid, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), to dryness.

EXTRACTUM LEPTANDRÆ. *U.S.* Extract of Leptandra.

	Metric.	Old form.
Leptandra, in No. 40 powder	1000 Gm.	82 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 750 C.c. [old form 24 fl. oz.] of Alcohol with 250 C.c. [old form 8 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Leptandra is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM NUCIS VOMICÆ. *U.S.* Extract of Nux Vomica.

	Metric.	Old form.
Nux Vomica, in No. 60 powder	1000 Gm.	82 oz. av.
Acetic Acid	50 C.c.	1½ fl. oz.
Alcohol,		
Water,		
Ether,		
Sugar of Milk, recently dried and in fine powder, each, a sufficient quantity.		

Mix Alcohol and Water in the proportion of 750 C.c. [old form 24 fl. oz.] of Alcohol to 250 C.c. [old form 8 fl. oz.] of Water. Mix the powder with 1000 C.c. [old form 32 fl. oz.] of the mixture, to which the Acetic Acid had previously been added, and let it macerate, in a well-covered vessel, in a warm place, during forty-eight hours. Then pack it tightly in a cylindrical glass percolator, gradually pour menstruum upon it, and continue the percolation, until the Nux Vomica is practically exhausted. Distil off the Alcohol by means of a water-

bath, transfer the remainder to a tared capsule, and evaporate it until it weighs about 150 Gm. [old form 5 oz. av.]. Transfer it to a bottle of the capacity of about 500 C.c. [old form 16 fl. oz.], and wash the capsule with about 50 C.c. [old form 1½ fl. oz.] of warm Water, adding the washings to the bottle and mixing the contents thoroughly. When the liquid extract is cold, add to it one-fourth of its volume of Ether, stopper the bottle, and bring the extract and Ether into intimate contact by gently agitating and frequently inverting the bottle, avoiding violent shaking so as to prevent the formation of an emulsion. Pour off the ethereal layer as closely as possible, and repeat this treatment with Ether several times, until a few drops of the ethereal layer no longer impart a permanent, greasy stain to filtering paper. Then transfer the contents of the bottle back to the tared capsule, using a sufficient quantity of warm Water for washing. Recover the Ether from the united ethereal washings, add to the oily residue about 15 C.c. [old form 231 minims] of boiling Water, and then Acetic Acid, in drops, until the mixture has a permanent acid reaction. Then filter it through a moistened filter, and wash the filter with a little water. Add the filtrate to the extract in the capsule, evaporate until the residue weighs about 200 Gm. [old form 6½ oz. av.], and allow it to become cold. Then determine its weight exactly, remove 4 Gm. [61.72 grains] of the mass, and assay this by the process given below, using the amounts of liquids there directed for 2 Gm. [30.9 grains] of dry extract. In another portion of 5 Gm. [77.16 grains] determine the amount of water by drying it, in a flat-bottomed capsule, at 100° C. (212° F.), until it ceases to lose weight. From the results thus obtained ascertain, by calculation, the amount of total alkaloids and of water contained in the remainder of the mass, add to this enough well-dried Sugar of Milk to bring the quantity of alkaloids in the final dry extract to 15 per cent., then evaporate the mass to complete dryness, reduce it to powder, and transfer it to small, well-stoppered vials.

Extract of Nux Vomica, when assayed by the following process, should be found to contain 15 per cent. of total alkaloids.

Assay of Extract of Nux Vomica.

Extract of Nux Vomica, dried at 100° C. (212° F.), *two grammes* . . 2 Gm.
Alcohol,
Ammonia Water,
Water,
Chloroform,
Decinormal Sulphuric Acid (V.S.),
Centinormal Potassium Hydrate V.S., each, *a sufficient quantity.*

Put 2 Gm. of the dried Extract of Nux Vomica into a glass separator, add to it 20 C.c. of a previously prepared mixture of 2 volumes of alcohol, 1 volume of ammonia water (specific gravity 0.960), and 1 volume of water, and shake the well-stoppered separator until the extract is dissolved. Then add 20 C.c. of chloroform and agitate during five minutes. Allow the chloroform to separate, remove it as far as possible, pour into the separator a few C.c. of chloroform, and, without shaking, draw this off through the stop-cock to wash the outlet-tube. Repeat the extraction with two further portions of chloroform of 15 C.c. each, and wash the outlet-tube each time as

just directed. Collect all the chloroformic solutions in a wide beaker, expose the latter to a gentle heat, on a water-bath, until the chloroform and ammonia are completely dissipated, add to the residue 10 C.c. of decinormal sulphuric acid measured with great care from a burette, stir gently, and then add 20 C.c. of hot water. When solution has taken place, add 2 C.c. of brazil wood T.S., and then carefully run in centinormal potassium hydrate V.S., until a permanent pinkish color is produced by the action of a slight excess of alkali upon the brazil wood indicator. Divide the number of C.c. of centinormal potassium V.S. used by 10, subtract the number found from 10 (the 10 C.c. of decinormal acid used), multiply the remainder by 0.0364 and that product by 50 (or, multiply at once by 1.82), which will give the percentage of *total alkaloids* in the Extract of Nux Vomica, it being assumed that strychnine and brucine are present in equal proportion, and the above factor being found by taking the mean of their respective molecular weights rounded off to whole numbers [(334 + 394) ÷ 2 = 364].

EXTRACTUM OPII. *U. S.* Extract of Opium.

	Metric.	Old form.
Powdered Opium	100 Gm.	3 oz. av. 231 gr.
Sugar of Milk, recently dried and in fine powder,		
Water, each, a sufficient quantity.		

Triturate the Powdered Opium in a mortar thoroughly with 1000 C.c. [old form 2 pints] of Water, repeat the trituration occasionally, in the course of twelve hours, then filter through a rapidly-acting, double filter, and wash the filter and residue with Water, until the filtrate is nearly colorless. Concentrate the filtrate and washings in a tared capsule, on a water-bath, until the residue weighs about 200 Gm. [old form 7 oz. av.], and allow it to become cold. Then determine the weight exactly, transfer 12 Gm. [old form 185.16 gr.] of it to an Erlenmeyer flask having a capacity of about 100 C.c. [old form 3½ fl. oz.], and determine in this portion the amount of morphine by the process of assay given below, using the quantities of liquids there directed for 4 Gm. [old form 61.72 gr.] of the dry extract. In another portion of 5 Gm. [old form 77.16 gr.] determine the amount of water by drying it in a flat-bottomed capsule, at 100° C. (212° F.), until it ceases to lose weight. From the results thus obtained ascertain, by calculation, the amount of morphine and of water contained in the remainder of the extract, add to this enough well-dried Sugar of Milk to bring the quantity of morphine in the final dry extract to 18 per cent., then evaporate the whole to dryness, reduce it to powder, and transfer it to small, well-stoppered vials.

Assay of Extract of Opium.

Extract of Opium, dried at 100° C. (212° F.), *four grammes*	4 Gm.
Ammonia Water, *two and two-tenths cubic centimeters*	2.2 C.c.
Alcohol,	
Ether,	
Water, each, a sufficient quantity.	

Dissolve the Extract of Opium in 30 C.c. of water, filter the solution through a small filter, and wash the filter and residue with water, until all soluble matters are extracted, collecting the washings separately. Evaporate, in a tared capsule, first, the washings to a small volume, then add the first filtrate, and evaporate the whole to a weight of 10 Gm. Rotate the concentrated solution about in the capsule until

the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 C c., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 15 Gm. Then add 7 Gm. (or 8.5 C.c.) of alcohol, shake well, add 20 C.c. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during ten minutes, and then set it aside, in a moderately cool place, for at least six hours, or over night.

Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel two rapidly-acting filters, of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 C.c. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 C.c. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 C.c in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother-water, and afterwards wash them, drop by drop, from a pipette, with alcohol previously sa·urated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 C.c., or more if necessary. Allow the filter to dry in a moderately warm place, at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass and weigh them.

The weight found, multiplied by 25, represents the amount of crystallized morphine obtained from 100 Gm. of the Extract.

EXTRACTUM PHYSOSTIGMATIS. *U. S.* Extract of Physostigma.

	Metric.	Old form.
Physostigma, in No. 80 powder	1000 Gm.	32 oz. av.
Alcohol, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Physostigma is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3½ fl. oz.]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, on a water-bath, to a pilular consistence.

EXTRACTUM PODOPHYLLI. *U. S.* Extract of Podophyllum.

	Metric.	Old form.
Podophyllum, in No. 60 powder	1000 Gm.	32 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 800 C.c. [old form 25½ fl. oz.] of Alcohol with 200 C.c. [old form 6½ fl. oz.] of Water, and, having moistened the powder with 300 C.c. [old form 9½ fl. oz.] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the

percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Podophyllum is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence.

EXTRACTUM QUASSIÆ. *U. S.* Extract of Quassia.

	Metric.	Old form.
Quassia, in No. 20 powder	1000 Gm.	82 oz. av.
Water, a sufficient quantity.		

Moisten the powder with 400 C.c. [old form 12½ fl. oz.] of Water, pack it firmly in a conical percolator, and gradually pour Water upon it until the infusion passes but slightly imbued with bitterness. Reduce the liquid to three-fourths of its bulk by boiling, and strain; then evaporate, by means of a water-bath, to a pilular consistence.

EXTRACTUM RHEI. *U. S.* Extract of Rhubarb.

	Metric.	Old form.
Rhubarb, in No. 30 powder	1000 Gm.	32 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 800 C.c. [old form 25½ fl. oz.] of Alcohol with 200 C.c. [old form 6½ fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the tincture passes nearly tasteless. Reserve the first 1000 C.c. [old form 2 pints] of the percolate, and set it aside in a warm place, until it is reduced by spontaneous evaporation to 500 C.c. [old form 1 pint]. Evaporate the remainder of the percolate, in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), to the consistence of syrup. Mix this with the reserved portion, and continue the evaporation, at or below the before-mentioned temperature, until the mixture is reduced to a pilular consistence.

EXTRACTUM STRAMONII SEMINIS. *U. S.* Extract of Stramonium Seed.

[EXTRACTUM STRAMONII, PHARM. 1880.]

	Metric.	Old form.
Stramonium Seed, in No. 60 powder	1000 Gm.	32 oz. av.
Diluted Alcohol, a sufficient quantity.		

Moisten the powder with 300 C.c. [old form 9½ fl. oz.] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until 3000 C.c. [old form 6 pints] of tincture are obtained, or the Stramonium Seed is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.]; mix this with the reserved portion, and, by means of a water-bath, evaporate at or below the before-mentioned temperature, to a pilular consistence.

EXTRACTUM TARAXACI. *U. S.* Extract of Taraxacum.

Taraxacum, freshly gathered in autumn, a convenient quantity,
Water, a sufficient quantity.

Slice the Taraxacum, and bruise it in a stone mortar, sprinkling Water over it from time to time, until it is reduced to a pulp; then express and strain the juice, and evaporate it in a vacuum-apparatus, or in a shallow porcelain dish, by means of a water-bath, to a pilular consistence.

Keep the Extract in a close vessel, and cover its surface with a cloth, which ought to be moistened occasionally with a little ether or chloroform.

EXTRACTUM UVÆ URSI. *U. S.* Extract of Uva Ursi.

	Metric.	Old form.
Uva Ursi, in No. 30 powder	1000 Gm.	32 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Mix 200 C.c. [old form 6½ fl. oz.] of Alcohol with 500 C.c. [old form 16 fl. oz.] of Water, and, having moistened the powder with 400 C.c. [old form 12½ fl. oz.] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Uva Ursi is exhausted. Reserve the first 900 C.c. [old form 28½ fl. oz.] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to 100 C.c. [old form 3 fl. oz.]. Mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, on a water-bath, to a pilular consistence.

Abstracta. *U.S.* 1880. *Abstracts.*

Abstracts are solid powdered preparations containing the soluble constituents of the drugs from which they are made, and bearing a definite and uniform relation to the drug. These preparations were first introduced into the U.S. Pharmacopœia of 1880, and have many advantages over ordinary extracts. They are prepared by evaporating an alcoholic tincture of a drug spontaneously and at a low temperature, mixing it with a sufficient quantity of dried sugar of milk to make the final product when dry weigh one-half the weight of the drug, and then powdering it. The following general formula exhibits the typical process. Abstracts are not official in the U. S. P. 1890, not having been used sufficiently during 1880–1890 by physicians to justify their reintroduction. One of their disadvantages is that they are not as concentrated as extracts.

General Formula.

Drug, in No. 60 powder, *two hundred parts* [or four ounces av.]; Sugar of Milk, recently dried and in fine powder, Alcohol, each, *a sufficient quantity,* To make *one hundred parts* [or two ounces av.]. Moisten the drug with *eighty parts* [or one and three-quarter fluidounces] of Alcohol, and pack firmly in a cylindrical glass percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until the drug is exhausted. Reserve the first *one hundred and seventy parts* [or three and one-half fluidounces] of the percolate, evaporate the remainder to *thirty parts* [or half a fluidounce] at a temperature not exceeding 50° C. (122° F.) and mix with the reserved portion. Place the mixture in an evaporating dish, and, having added *fifty parts* [or one ounce av.] of Sugar of Milk, cover it with a piece of thin muslin gauze, and set aside in a warm place, where the temperature will not rise above 50° C. (122° F.), until the mixture is dry. Lastly, having added enough Sugar of Milk to make the mixture weigh *one hundred parts* [or two ounces av.], reduce it to a fine, uniform powder. Preserve the powder in a well-stopped bottle.

The advantages possessed by abstracts may be briefly stated as follows:

1. Each abstract represents twice the strength of the drug or fluid extract from which it is prepared.

2. They are dry powders, if properly made, and thus are permanent and portable; not subject to precipitation as fluid extracts are; not liable to become hard, tough, and variable in strength, as is the case with extracts.

3. Injurious exposure to heat is entirely avoided, and the official process requires no apparatus but such as either is at hand in the pharmacy or can be easily obtained by a pharmacist operating upon the small scale.

4. The final thorough trituration of the dry powder reduces the soluble and active constituents of the drug to a pulverulent condition, the diluent is soluble, and the fine state of division of abstracts is the most favorable condition that a powder can possess to secure efficient medication.

The improvement suggested for the processes for abstracts is, that the temperature 50° C. (122° F.), which is lower than need be, for abstracts of aconite, belladonna, digitalis, hyoscyamus, ignatia, jalap, nux vomica, podophyllum, and senega, be increased to 80° C. (176° F.).

Conium and valerian require a very low temperature, but the temperature of 80° C. (176° F.) is not injurious to those first mentioned if the evaporation of the fluid extract is quickly and carefully effected. An alcoholic fluid extract may be used to prepare an abstract from, if the menstruum used in making it was not too aqueous, and if it is free from glycerin. Dr. Squibb's modification for making abstracts from fluid extracts, as shown in the case of fluid extract of aconite, is as follows: "Put the fluid extract (a weighed quantity) upon a flat-bottomed dinner-plate and allow it to evaporate spontaneously, without heating, for twenty-four or thirty-six hours. At the end of that time there will remain upon the plate a thin layer of solid extract. Add to this extract about double its weight of powdered sugar of milk, warm the plate and contents until it can be just comfortably held in the hand, and incorporate the melted extract and powder by means of a stiff spatula. When thoroughly incorporated and cold, remove the mixture from the plate, weigh it, and add enough powdered sugar of milk to make the whole weigh one-half the original weight of the fluid extract. Finally, rub it to a fine, uniform powder, sifting it through a No. 60 sieve." Abstracts are *not* well made when the dry powdered solid extract is simply rubbed up with dry powdered sugar of milk, as suggested by some writers, because such mixtures of dry powders invariably *stratify* in time. This fault may be easily discovered on close examination, a darker layer of powdered extract being succeeded by a lighter one containing variable proportions of sugar of milk: this arrangement of the particles is largely owing to the vibration to which the bottles containing them are continually subjected on the shelves of the dispensing counter and by use elsewhere. If the U. S. 1880 process is employed, this fault does not exist, because the particles of sugar of milk become thoroughly saturated with the concentrated liquid extract when mixed together, and when the alcohol evaporates the solid extract is thoroughly diffused among, and is closely adherent to, the particles of sugar of milk: hence a dose taken from the portion at the top or at the middle of the bottle would have the same medicinal effect as one taken from the portion at the bottom.

Preservation and Administration.—Abstracts should be carefully protected from exposure to moist air. They should be kept in small bottles with mouths wide enough to admit the end of a spatula. Corks of the best quality should be used, and the bottles should not be kept near a hot flue, but in as cool a place as possible.

The following table exhibits the *eleven* U. S. 1880 abstracts in a form convenient for study:

Abstracta. *U. S.* 1880. *Abstracts.*

Name.	Fineness of Powder.	Menstruum.	To moisten 200 Parts.	Quantity reserved.	Notes and Additions.
Abstractum Aconiti.	60	Alcohol.	80	170	2 per cent. Tartaric Acid added to menstruum to exhaust Aconite Root.
Belladonnæ.	60	"	80	170	From Belladonna Root.
Conii.	40	"	80	170	6 per cent. Hydrochloric Acid added to menstruum to exhaust Conium Fruit.
Digitalis.	60	"	80	170	
Hyoscyami.	60	"	80	170	
Jalapæ.	40	"	100	170	
Podophylli.	60	"	80	170	
Senegæ.	60	"	80	170	
Valerianæ.	60	"	80	170	
Ignatiæ.	60	Alcohol, 8; Water, 1	100	170	
Nucis Vomicæ.	60	Alcohol, 8; Water, 1	100	170	

Resinæ. *Resins.*

The official resins are solid preparations consisting principally of the resinous principles from vegetable bodies. Official resins differ from alcoholic extracts in the fact that the latter contain all the principles in the drug which alcohol is capable of dissolving, whilst the resins contain only those principles which are soluble in alcohol and are insoluble in water. It is obvious that the resins prepared from those drugs which owe their activity exclusively to resinous principles, which are insoluble in water, are stronger preparations than the alcoholic extracts from such drugs. *Five* resins are official:

Official Resins.

Name.	Preparation.
Resina	By-product, the residue left from distilling Oil of Turpentine.
Copaibæ	By-product, the residue left after distilling off the volatile oil from Copaiba.
Jalapæ	Percolate Jalap, in No. 60 powder, with Alcohol until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, and add the concentrated tincture to water, collect, wash, drain, and dry the precipitate.
Podophylli . . .	Percolate Podophyllum, in No. 60 powder, with Alcohol until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, and add the concentrated tincture to cold water, acidulated with 1 per cent. of Hydrochloric Acid, collect, wash, drain, and dry the precipitate.
Scammonii . . .	Digest Scammony with boiling Alcohol until exhausted, mix the tinctures, distil off the alcohol, add the concentrated tincture to water, wash and dry the precipitate.

RESINA. *U.S.* Resin.

[COLOPHONY.]

The residue left after distilling off the volatile oil from Turpentine.

A transparent, amber-colored substance, hard, brittle, pulverizable; fracture glossy and shallow-conchoidal; odor and taste faintly terebinthinate. Specific gravity 1.070 to 1.080.

Soluble in alcohol, ether, and fixed or volatile oils; also in solution of potassium or sodium hydrate.

RESINA COPAIBÆ. *U.S.* Resin of Copaiba.

The residue left after distilling off the volatile oil from Copaiba.

A yellowish or brownish-yellow, brittle resin, having a slight odor and taste of copaiba.

Soluble in alcohol, ether, chloroform, carbon disulphide, benzol, or amylic alcohol.

RESINA JALAPÆ. *U.S.* Resin of Jalap.

	Metric.	Old form.
Jalap, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Moisten the powder with 300 C.c. [old form 9½ fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until 2500 C.c. [old form 5 pints] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to 400 Gm. [old form 12½ fl. oz.], and add the latter, with constant stirring, to 9000 C.c. [old form 18 pints] of Water. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of Water. Place it upon a strainer, and, having pressed out the liquid, dry the Resin with a gentle heat, stirring occasionally until the moisture has evaporated.

Yellowish-brown, or brown masses or fragments, breaking with a resinous, glossy fracture, translucent at the edges, or a yellowish-gray or yellowish-brown powder, having a slight, peculiar odor, and a somewhat acrid taste. Permanent in the air.

Its alcoholic solution has a faintly acid reaction.

Soluble in alcohol in all proportions; insoluble in carbon disulphide, benzol, and fixed or volatile oils. Not more than about 10 per cent. of it is soluble in ether.

On evaporating the ethereal solution, and dissolving the residue in potassium hydrate T.S., a reddish-brown liquid is formed, from which the resin is reprecipitated by acids. If that portion of Resin of Jalap which remained undissolved by ether be dissolved in potassium hydrate T.S., the addition of an acid does not precipitate it.

Resin of Jalap should not suffer any material loss of weight when heated at 100° C. (212° F.) (absence of *water*).

Water triturated with it should neither become colored, nor take up anything soluble from it (absence of *soluble impurities*).

On digesting 1 Gm. of Resin of Jalap for about an hour, with frequent agitation, in a glass-stoppered vial, with 10 C.c. of ammonia water, at a temperature of about

80° C. (176° F.), it should yield a solution which does not gelatinize on cooling (absence of *common resin*).

RESINA PODOPHYLLI. *U. S.* Resin of Podophyllum.

	Metric.	Old form.
Podophyllum, in No. 60 powder	1000 Gm.	82 oz. av.
Hydrochloric Acid	10 C.c.	150 minims.
Alcohol,		
Water, each, a sufficient quantity.		

Moisten the powder with 480 C.c. [old form 15 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until 1600 C.c. [old form 3½ pints] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distil off the Alcohol, by means of a water-bath, until the tincture is reduced to a syrupy consistence, and pour it slowly, with constant stirring, into 1000 C.c. [old form 2 pints] of Water, previously cooled to a temperature below 10° C. (50° F.), and mixed with the Hydrochloric Acid. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of cold Water. Spread it, in a thin layer, upon a strainer, and dry the Resin by exposure to the air, in a cool place. Should it coalesce during the drying, or aggregate into lumps having a varnish-like surface, it should be removed, broken in pieces, and rubbed in a mortar. As this is liable to happen during warm weather, Resin of Podophyllum is preferably made during the cold season.

An amorphous powder, varying in color from grayish-white to pale greenish-yellow or yellowish-green, turning darker when exposed to a heat over 35° C. (95° F.); having a slight, peculiar odor, and a peculiar, faintly bitter taste. Permanent in the air.

Its alcoholic solution has a faintly acid reaction.

Soluble in alcohol in all proportions; ether dissolves 15 to 20 per cent. of it; boiling water dissolves about 80 per cent., and deposits most of it again on cooling, the remaining, clear aqueous solution having a bitter taste, and turning brown on the addition of ferric chloride T.S.

Resin of Podophyllum is also soluble in potassium or sodium hydrate T.S., forming a deep yellow liquid, which gradually becomes darker, and from which the resin is reprecipitated by acids.

RESINA SCAMMONII. *U. S.* Resin of Scammony.

	Metric.	Old form.
Scammony, in No. 60 powder	1000 Gm.	82 oz. av.
Alcohol,		
Water, each, a sufficient quantity.		

Digest the Scammony with successive portions of boiling Alcohol until it is exhausted. Mix the tinctures, and reduce the mixture to a syrupy consistence by distilling off the Alcohol. Then add the residue in a thin stream, with active stirring, to 2500 C.c. [old form 5

pints] of Water, separate the precipitate formed, wash it thoroughly with Water, and dry it with a gentle heat.

Yellowish-brown or brownish-yellow masses or fragments, breaking with a glossy, resinous fracture, translucent at the edges; or a yellowish-white or grayish-white powder, having a faint, peculiar odor, and a slight, peculiar taste.

Soluble in alcohol in all proportions; also wholly soluble in ether and in oil of turpentine. Ammonia water and solutions of alkalies dissolve it with the aid of a gentle heat; from these solutions the resin is not reprecipitated by acids.

QUESTIONS ON CHAPTER XXX.

SOLID PREPARATIONS MADE BY PERCOLATION.

What are extracts?
What various menstrua are used in making them?
By what names are such extracts called?
What are inspissated juices?
Why are alcoholic extracts preferred to those made from inspissated juices?
What representative of this class of preparations is official in the U. S. P.?
How are these juices prepared by the British Pharmacopœia?
How have extracts been prepared by the freezing process?
Do the percolates or expressed juices of drugs contain anything in addition to the active principles?
What proximate principles are most commonly present in extracts?
Which of these principles are absent when a menstruum of part alcohol is used?
What is meant by extractive?
What name was proposed for this substance by Berzelius?
Why are extracts variable in strength?
What is the Pharmacopœia's standard for the consistence of extracts?
In what respect have "abstracts" an advantage over "extracts"?
Are extracts a reliable class of preparations?
How may extracts be preserved?
Give the general formula for alcoholic extracts?
To what extracts is glycerin added?
How many official extracts are there?
Give the Latin official name, menstruum, and mode of preparing extract of aconite, aloes, Indian cannabis, cimicifuga, colchicum root, compound extract of colocynth, gentian, jalap, opium, taraxacum, uva ursi, juglans, mezereum, physostigma, nux vomica, cinchona, podophyllum, iris, rhubarb, belladonna (leaves), digitalis, leptandra, hyoscyamus, arnica root, colocynth, conium (fruit), euonymus, stramonium (seed).
How many official extracts are made with an aqueous menstruum? Name them.
Which one is percolated with water containing five per cent. of water of ammonia?
Which is made with a menstruum of water containing 23.8 per cent. of official acetic acid?
Which by evaporating a fluid extract?
Which by mixing extracts with aromatics?
Which one is an inspissated juice?
What kind of cinchona is directed to be used in extract of cinchona?
What are the ingredients of compound extract of colocynth?
What fineness of powder is directed?
What is the consistence of the finished product?
What is the strength of extract of ergot?
From what plant is extract of glycyrrhiza obtained?
How much of it should be soluble in cold water?
Why should the use of metallic vessels be avoided in making extract of hæmatoxylon?
Should metallic vessels be avoided in making extract of krameria? Why?

What are abstracts?
When were they introduced into the U. S. P.?
Are abstracts now official?
Give the general formula for their preparation.
What advantages do they possess over ordinary extracts?
What improvements for making abstracts may be suggested?
What is Dr. Squibb's modification of the process?
Can abstracts be made satisfactorily from solid extracts? Why not?
What are official resins?
How are they prepared?
In what respect do they differ from alcoholic extracts?
How many resins are official? Name them.
How is resin of copaiba prepared? Give a description of it.
Give the Latin name and menstruum of resin of jalap.
How is it prepared?
How may it be distinguished from resin of podophyllum? From resin of scammony?
Give the Latin name and menstruum of podophyllum. Resin of scammony.
How may these be distinguished?

CHAPTER XXXI.

SOLID OFFICIAL PREPARATIONS MADE WITHOUT PERCOLATION.

It is not the intention in this chapter to consider *in detail* the classes of solid official preparations included in the above title, because their manufacture either belongs to the domain of extemporaneous pharmacy or is intimately connected with it. They are more appropriately treated in the final chapters of the work, because their preparation generally demands a higher degree of skill, and a more intimate knowledge of the physical properties of medicinal substances, than are necessary in making those which have been heretofore considered. For these reasons it has been the author's custom, in lecturing upon the subjects treated of in this work, to reserve the consideration of the solid official preparations made without percolation, and those which are embraced under the general term "extemporaneous," until after the student has studied the physical and chemical properties of the various substances which compose the materia medica. It is well for the student to have sufficient knowledge of these preparations to be able to define each class, so that when they are incidentally mentioned in Parts III. and IV. he may be able to describe the use and appearance of a powder, troche, plaster, pill, etc. If it is considered desirable to deviate from this plan, the chapters on these subjects are so constructed that the student may easily turn to them and study them out of the order given here. They will be found in Part VI.

It will be well, however, in this place, in order to keep the classification in view, to enumerate them briefly. They are Pills, Troches, Masses, Confections, Powders, Triturations, Suppositories, Cerates, Ointments, Plasters, and Papers. Among those intended for internal administration pills and troches are largely used, and, because their preparation requires the drugs to be in the form of powder, the classes termed powders and triturations, which are dispensed extemporaneously, are grouped with them. Masses and confections are of course considered in connection with pills, because they are used in their preparation. Suppositories stand alone as a class, whilst cerates, ointments, plasters, and papers form a natural group, being preparations that are used externally.

PART III.

INORGANIC SUBSTANCES.

INTRODUCTORY.

THE various operations and processes which are used in the practice of pharmacy having been treated of in their general relations to one another in the preceding chapters, it is now necessary to consider in detail the physical and chemical properties of the substances that enter into the preparations which are used in medicine.

The plan which will be followed presupposes on the part of the student a knowledge of elementary chemistry, and hence chemical physics, nomenclature, the theoretical construction of formulæ, etc., will not be entered into. The great number of valuable text-books on chemistry, now accessible to every student, renders the introduction of even brief articles on these subjects unnecessary, and the space will be reserved for the consideration of the chemical substances of the materia medica from a pharmaceutical stand-point. For reasons which need not be entered into here, the latest (and to some extent conflicting) views of modern chemists upon the classification of these substances are not adopted, but a method is employed which, whilst it does not do violence to the accepted theories, is simple and practical. The substances are grouped together according to their physical or therapeutical properties, whilst their supposed chemical analogies have not been entirely overlooked. This plan has the merit of giving the student a different view of the chemical substances from that to which he is accustomed in his study of chemistry, and will, perhaps, enhance the interest and impress the points of difference in the substances more forcibly upon the mind.

As an illustration, the chemical properties of the non-metallic elements—Hydrogen, Oxygen, and Nitrogen—will not be noticed at length; they are not recognized articles of the materia medica in their free state; but the acids, bases, and salts containing them are largely used, and they form substances which can be advantageously grouped together for profitable study by the pharmacist.

The table which follows gives the symbols and atomic weights of the elements; those which are of special interest from a pharmaceutical point of view are distinguished from the rest by being printed in heavier type. The figures given in the last column are those of Meyer and Seubert, and are now official.

Table of Elementary Substances.

Element.	Symbol.	Atomic Weight.	Official Atomic Weight.	Element.	Symbol.	Atomic Weight.	Official Atomic Weight.
Aluminum . .	Al	27	27.04	Molybdenum .	Mo	95.5	95.9
Antimony . .	Sb	120	119.6	Nickel	Ni	58	58.6
Arsenic . . .	As	74.9	74.9	Niobium . . .	Nb	94	93.07
Barium	Ba	136.8	136.9	**Nitrogen** . . .	N	14	14.01
Beryllium . .	Be	9	9.08	Osmium . . .	Os	198.5	190.3
Bismuth . . .	Bi	210	208.9	**Oxygen** . . .	O	16	15.96
Boron	B	11	10.9	Palladium . .	Pd	105.7	106.35
Bromine . . .	Br	79.8	79.76	**Phosphorus** .	P	31	30.96
Cadmium . . .	Cd	111.8	111.5	**Platinum** . . .	Pt	194.4	194.3
Cæsium	Cs	132.6	132.7	**Potassium** . .	K	39	39.03
Calcium . . .	Ca	40	39.91	Rhodium . . .	Rh	104.1	102.09
Carbon	C	12	11.97	Rubidium . . .	Rb	85.3	85.2
Cerium	Ce	141	139.9	Ruthenium . .	Ru	104.2	101.4
Chlorine . . .	Cl	35.4	35.37	Samarium . . .	Sm	. .	149.62
Chromium . .	Cr	52.4	52.0	Scandium . . .	Sc	44	43.97
Cobalt	Co	58.9	58.6	Selenium . . .	Se	78.8	78 87
Columbium . .	Cb	94	93.07	**Silicon**	Si	28	28 3
Copper	Cu	63.2	63.18	**Silver**	Ag	107.7	107.66
Didymium . .	Di	144.6	142.0	**Sodium** . . .	Na	23	23.0
Erbium	Er	165.9	166.0	Strontium . .	Sr	87.4	87.3
Fluorine . . .	F	19	19.0	**Sulphur** . . .	S	32	31.98
Gallium . . .	G	68.8	69.9	Tantalum . . .	Ta	182	182.0
Germanium . .	Ge	. .	72.08	Tellurium . . .	Te	128	125.0
Glucinum . . .	Gl	9	9.08	Terbium . . .	Tb	. .	159.1
Gold	Au	196.2	196.7	Thallium . . .	Tl	203.7	203.7
Hydrogen . .	H	1	1.0	Thorium . . .	Tb	233	231.9
Indium	In	113.4	113.6	**Tin**	Sn	117.7	118.8
Iodine	I	126.6	126.53	Titanium . . .	Ti	48	48.0
Iridium	Ir	192.7	192.5	Tungsten . . .	W	183.6	183.6
Iron	Fe	55 9	55.88	Uranium . . .	U	238.5	238.8
Lanthanum . .	La	138.5	138.2	Vanadium . .	V	51.3	51.1
Lead	Pb	206.5	206.4	Ytterbium . .	Yb	172.7	172.6
Lithium . . .	Li	7	7.01	Yttrium . . .	Yt	89.8	88.9
Magnesium . .	Mg	24	24.08	**Zinc**	Zn	64.9	65.1
Manganese . .	Mn	54	54 8	Zirconium . .	Zr	90	90.4
Mercury . . .	Hg	199.7	199.8				

CHAPTER XXXII.

HYDROGEN, OXYGEN, AND WATER.

H; 1. O; 15.96. H_2O; 17.96.

Hydrogen is a colorless, inodorous, and combustible gas; it is the lightest of all substances. Chemically, it is one of the most important and interesting of the elements, the atomic weights of all being referred to it as unity. Pharmaceutically, in its uncombined state, it is of very little importance, and the reader is referred, for further information, to the chemical text-books.

Oxygen, as usually seen, is a colorless, inodorous gas which aids combustion; it is the most abundant of the elements, forming about one-fifth of the total weight of our atmosphere. Water contains nearly ninety per cent. by weight of oxygen, and it is present in varying quantities in most vegetable and animal substances. The compounds which it forms with other bodies are termed oxides: these are of great pharmaceutical interest, and they will be considered hereafter under their appropriate heads. Oxygen in its free, gaseous condition is sometimes used medicinally, but in this state it is of little importance in pharmacy.

AQUA. *U. S.* Water.

$H_2O = 17.96.$

Natural water in its purest attainable state.

Water is the most important and useful compound known to the pharmacist: its molecule, H_2O, is composed of two parts of hydrogen and one part of oxygen.

The purity of water is specified in the official description, which is as follows:

Aqua. *U. S.*	Impurities.	Tests for Impurities.
A colorless, limpid liquid, without odor and taste at ordinary temperatures, and remaining odorless while being heated to boiling, of a perfectly neutral reaction.	Metallic impurities.	The transparency or color of Water should not be affected by hydrogen sulphide T.S. or ammonium sulphide T.S.
	Sulphates.	If 200 C.c. of Water be acidulated with hydrochloric acid and heated to boiling, and 0.5 Gm. of barium chloride T.S. added, the liquid, cooled and filtered, should give no further precipitate on the addition of a few drops of barium chloride T.S., even on standing.
	Ammonia.	It should remain unaffected by mercuric chloride T.S.
	Soluble salts.	On evaporating 1000 C.c. of Water on a water-bath, it should not leave a residue weighing more than 0.5 Gm.
	Ammoniacal or acid vapors.	The above residue, when ignited, should not carbonize.
	Chlorides.	If 200 C.c. of Water be acidulated with nitric acid and 0.5 C.c. of decinormal silver nitrate V.S. be added, the filtered liquid should not be affected by the subsequent addition of a few drops of silver nitrate T.S.

Aqua. U. S.	Impurities.	Tests for Impurities.
	More than traces of organic or other oxidizable matters.	On heating 100 C.c. of Water acidulated with 10 C.c. of diluted sulphuric acid to boiling, and adding 0.5 C.c. of decinormal potassium permanganate V.S. to impart to the liquid a decided rose-red tint, this tint should not be entirely destroyed by boiling for ten minutes.
	Nitrites.	If 100 C.c. of Water be acidulated with diluted sulphuric acid free from nitrose, and a few drops of zinc-iodide starch T.S. subsequently added, the liquid should not at once assume a blue or violet color.
	Nitrates.	If 5 C.c. of Water mixed with a few drops of diphenylamine T.S. be carefully poured upon about 2 C.c. of sulphuric acid, free from nitrose, contained in a test-tube, so as to form a separate layer, no blue color should be formed at the line of contact of the two liquids.

Uses.—The powers and uses of water as a solvent have been already noticed in the previous chapters. The United States Pharmacopœia directs water, under the name of Aqua, or distilled water, under the name of Aqua Destillata, to be used in the various processes according to the necessities of the occasion. Ordinary water always contains solid matter and traces of various salts in solution or suspension: these do not unfit it for drinking purposes, but would often seriously interfere with the purity of many chemical substances if such water were used in their preparation. The official processes err on the safe side, and direct distilled water in all cases where the use of ordinary water might be injurious or of doubtful propriety. In some sections of the country the drinking-water might be pure enough for the processes, or at least not contain serious impurities; in other sections the water would be totally unfit for the preparations. The purity of official distilled water is beyond question, and its use therefore removes all doubts.

For distilled water the tests for purity are, of course, much more exacting (see below).

Aqua Destillata. U. S.	Impurities.	Tests for Impurities.
A colorless, limpid liquid, without odor or taste, and of a neutral reaction. On evaporating 1000 C.c. of Distilled Water, on a water-bath, to dryness, no residue should remain.		The transparency or color of Distilled Water should not be affected by any of the following tests:
	Metals.	Hydrogen sulphide or ammonium sulphide T.S.
	Sulphate.	Barium chloride T.S.
	Chloride.	Silver nitrate T.S.
	Calcium.	Ammonium oxalate T.S.
	Ammonium Salts, or Free Ammonia.	Mercuric chloride T.S.
	Carbonic acid.	Twice its volume of calcium hydrate T.S.
	Nitrites or Nitrates.	It should give no reaction for these, when tested as described under Aqua.
	Organic or other oxidizable matters.	On heating 100 C.c. of Distilled Water, acidulated with 10 C.c. of diluted sulphuric acid, to boiling, and adding 1 C.c. of centinormal potassium permanganate V.S. to impart to the liquid a decided rose-red tint, this tint should not be entirely destroyed by boiling for ten minutes, nor by subsequently setting the vessel aside, well covered, for ten hours.

Uses.—Distilled water is used in pharmacy principally as a solvent for delicate chemical salts, and for purposes for which ordinary water is unfitted (see page 469).

AQUA HYDROGENII DIOXIDI. *U. S.* Solution of Hydrogen Dioxide.

[SOLUTION OF HYDROGEN PEROXIDE.]

A slightly acid, aqueous solution of Hydrogen Dioxide (H_2O_2 = 33.92) containing, when freshly prepared, about 3 per cent., by weight, of the pure Dioxide, corresponding to about 10 volumes of available oxygen. Specific gravity, about 1.006 to 1.012 at 15° C. (59° F.).

This is a valuable addition to the official preparations of the U. S. P. 1890. It is made commercially now on a large scale. Its method of preparation, by decomposing barium dioxide with phosphoric acid, will be found in detail on page 290.

$$BaO_2 + 2H_3PO_4 = Ba(H_2PO_4)_2 + H_2O_2.$$

Any trace of barium salt in the solution of hydrogen dioxide remaining after the decomposition is removed by the cautious addition of sulphuric acid, which precipitates an insoluble barium sulphate.

Aqua Hydrogenii Dioxidi. *U. S.*	Odor, Taste, Reaction, etc.	Solubilities.	
		Water.	Alcohol.
A colorless liquid; liable to deteriorate by age, exposure to heat, or protracted agitation. When exposed to the air at the ordinary temperature, or when heated on a water-bath at a temperature not exceeding 60° C. (140° F.), the Solution loses chiefly water. When rapidly heated, it is liable to decompose suddenly.	Odorless, slightly acidulous to the taste, producing a peculiar sensation and soapy froth in the mouth. Acid reaction due to small amount of free acid allowed to remain in it for preservation. Sp. gr. 1.006 to 1.012 at 15° C. (59° F.).	Miscible in all proportions.	Miscible in all proportions.

Tests for Identity.	Impurities.	Tests for Impurities.
On adding 10 C.c. of water, in a test-tube, 1 drop of potassium chromate T.S., then 10 drops of diluted sulphuric acid, and pouring a few C.c. of ether on top, the subsequent addition of a few drops of Solution of Hydrogen Dioxide, even when considerably diluted, will cause a blue color to appear at the zone of contact of the two liquids. After shaking, the ethereal layer will separate with a blue color.	Hydrofluoric acid.	Upon evaporating 50 C.c. of the Solution, previously rendered alkaline by sodium hydrate T.S. to dryness, transferring the dry residue to a watch-glass, moistening it with sulphuric acid, and setting the glass in a moderately warm place for a few hours, the surface of the glass, after being washed, should exhibit no sign of corrosion.
On evaporating 50 C.c. of the Solution to dryness, on a water-bath, not more than 0.25 Gm. of residue should remain.	Limit of free acid.	50 C.c. of the Solution should not require more than 0.5 C.c. of potassium hydrate V.S. to render the liquid alkaline, phenolphtalein being used as an indicator.
	Barium.	The addition of a few drops of diluted sulphuric acid to 10 C.c. of the Solution should produce no turbidity or precipitate.

Valuation of Solution of Hydrogen Dioxide.

Dilute 10 C.c. of the Solution with water to make 100 C.c. Transfer 17 C.c. of this liquid (containing 1.7 C.c. of the Solution) to a beaker, add 5 C.c. of diluted sulphuric acid, and then, from a burette, decinormal potassium permanganate V.S., until the liquid just retains a faint pink tint after being stirred. Each C.c. of the decinormal potassium permanganate V.S. corresponds to 0.0017 Gm. of absolute Hydrogen Dioxide.

To express the strength of any solution of Hydrogen Dioxide approximately in *volumes of available oxygen* (that is, in volumes of oxygen given off by 1 volume of the Solution upon decomposition), multiply the number of C.c. of decinormal permanganate V.S. decolorized by 1 C.c. of the Solution, by 0.56 (0.5594); or those decolorized by 1.7 C.c. of the Solution, by 0.33. (It is assumed that 1000 C.c. of oxygen, at 0° C. (32° F.) and 760 Mm. pressure, weigh 1.43 Gm.)

To express the strength in *percentage* (*by weight*) *of absolute Hydrogen Dioxide*, multiply the number of C.c. of decinormal permanganate V.S. decolorized by 1 C.c. of it, by 0.17; or divide the number of C.c. of permanganate V.S. decolorized by 1.7 C.c. of it, by 10.

Uses.—Solution of hydrogen dioxide (or peroxide, as it is usually termed) is an energetic antiseptic and disinfectant; as found in commerce, it is designated as a 15 vol., 10 vol., 8 vol. solution, etc., by which is meant a solution of the hydrogen dioxide which will yield 15 volumes, 10 volumes, or 8 volumes of active oxygen when used. Diluted solutions are employed as local applications and in inflammations of mucous membranes. It is probably free from poisonous properties. *Great care must be exercised to prevent decomposition, and the bottles containing the solution must be kept in a cool place.*

CHAPTER XXXIII.

THE INORGANIC ACIDS.

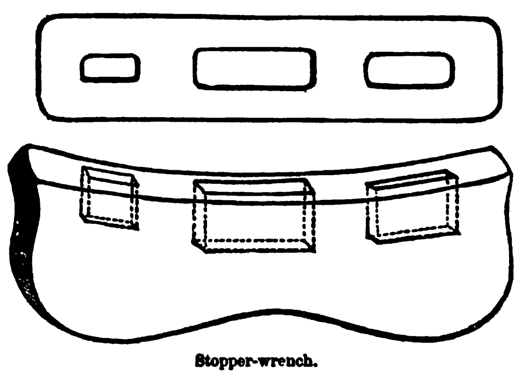
THE inorganic acids form one of the most important classes of compounds used in pharmacy. Acids are distinguished from other bodies by the following properties: 1. They all contain hydrogen, and are sometimes called hydrogen salts. The hydrogen is capable of being replaced by metals. 2. Those which are soluble in water have a characteristic sour taste and corrosive action. 3. They act on litmus and other vegetable substances, changing their color.

The official inorganic acids will be considered in the following order: 1. Those which do not contain oxygen, or *hydracids*, and which are derived from non-metallic elements,—viz., Hydrochloric and Hydrobromic Acids. 2. The non-metallic oxygen acids,—Nitric, Nitrohydrochloric, Sulphuric, Sulphurous, Hypophosphorous, and Phosphoric Acids. 3. Those obtained from metallic elements,—Arsenous and Chromic Acids,—and now termed anhydrides, including the weak acid obtained from Boron, will not be treated as acids, but will be described under the headings of the elements from which they are formed.

The names of the acids which contain oxygen vary in their terminations like the salts of certain metals,—the suffixes *ous* and *ic* being used, the former to denote the lower proportion of oxygen, the latter the higher. Thus, sulphur*ous* acid, H_2SO_3, contains less oxygen than sulphur*ic* acid, H_2SO_4; nitr*ous* acid, HNO_2, less than nitr*ic* acid, HNO_3, etc.

Practical Points in Handling Strong Acids.—The strong inorganic acids are never made by the pharmacist for commercial purposes, as they can be manufactured much more economically upon the large scale. They are corrosive in their action, and must be handled very cautiously to avoid personal injury. They are usually sent out by manufacturers in one-pound, or in five-pint, glass-stoppered bottles, or in carboys holding about ten gallons. One of the common annoyances is the liability of the glass stopper to become so tightly fastened in the neck of the bottle that it is

FIG. 348.



Stopper-wrench.

extracted with difficulty. As this always happens with bottles which have well-fitting and hence most valuable stoppers, it becomes an object to extract the stopper without injury. This may frequently be done by grasping the bottle firmly, and, after cleaning off the lute, carefully tapping the stopper *gently* with the *wooden* handle of a pestle or spatula. If very moderate measures do not succeed, the stopper-wrench (see Fig. 348) should be used. This is made of hard wood, of the shape shown in the cut, the upper cut giving the end view and showing the relative sizes of three holes in the wrench. These should be made somewhat larger than the stoppers of the bottles that the wrench is likely to be used for. The lower cut gives the side view of the wrench, which is shaped to fit the hand, and shows the relative depths of the holes. The refractory stopper is placed in the hole, and the operator grasps the wrench with the right hand and endeavors to twist the stopper out. If it does not yield to moderate treatment, the neck of the bottle may be cautiously heated by wrapping it in a cloth wet with hot water, or by means of a spirit-lamp or Bunsen burner with a low flame, passing the flame quickly around it several times so that it shall be uniformly heated. This will cause expansion of the neck, and if the right moment be seized, which is just before the outer surface of the stopper becomes correspondingly heated, the stopper may be easily extracted, the principle of action depending upon unequal expansion. If these means do not succeed, the bottle should be inverted in a vessel of warm water to a depth sufficient to cover the neck, and allowed to remain several hours; if the wrench is then used, success is generally assured. Corks should not be used as stoppers for the strong acids, because of the corrosive action of the latter on them,—a portion of the cork almost invariably contaminating and discoloring the acid.

The handling of carboys containing strong acids is sometimes attended with difficulty and danger. The simplest method known to the author is by the use of Stevenson's carboy rocker (see Fig. 349). This

FIG. 349.

Use of carboy rocker.

consists of a solid elastic steel rod bent into the shape shown in the cut. To place it in position, the carboy is tilted until it rests on a bottom corner; the closed end of the rocker is then pushed into place on the

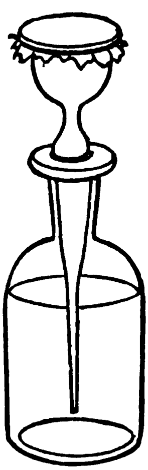
bottom edge, and the springs adjust themselves to the upper edge of the carboy. The latter can then be tilted easily and without spilling the contents. The last drop can be poured out readily.

Quality of Commercial Acids.—Two grades of acids are found in commerce. The first is designated as C. P. (chemically pure), and this is the quality indicated by the U. S. Pharmacopœia to be used in making preparations and for tests, etc. The lower grade is sometimes known as medicinally pure, and is intended to be employed in the arts and for common uses.

Too much importance cannot be attached to the duty of securing pure and strong acids. The introduction of full and reliable tests in the Pharmacopœia of 1890 leaves the pharmacist without excuse if he neglects their careful examination. They are used in many of the qualitative and quantitative official tests. If the reagent used for testing is impure itself, the substance which is suspected and is being tested will fall under condemnation when it may be absolutely faultless. Then, again, loss and annoyance in making many preparations, like the iron salts and solutions, will surely follow the use of acids deficient in strength and purity.

Strength of the Official Acids.—The official inorganic acids are mostly solutions of gaseous acids in water, and no uniformity is to be found among them in the amount of water contained in the strong acids. For instance, hydrochloric acid contains 31.9 per cent. of gaseous hydrochloric acid; nitric acid contains 68 per cent. of gaseous nitric acid; and sulphuric acid contains 92.5 per cent. of absolute sulphuric acid. On the other hand, the *diluted* acids are intended to be uniform,—diluted hydrochloric, nitric, and sulphuric acids each containing 10 per cent. of absolute acid.

FIG. 350.



Acid-dropper.

Medical Properties.—The inorganic acids are generally tonic and refrigerant when administered in a diluted condition; externally, if applied undiluted, they are caustic and corrosive, and should be used with the greatest care. Brushes made of spun glass are sometimes employed to apply strong acids externally to ulcers. Test-bottles with elongated stoppers, or the bottle shown in Fig. 350, are also advantageously used. One of the principal difficulties attendant upon the internal administration of acids is their injurious action upon the teeth. To avoid the destructive contact with the enamel, the diluted acid should be sucked through a narrow glass tube.

Antidotes.—The strong acids are sometimes accidentally taken internally in poisonous doses; their corrosive action is rapidly manifested, and dangerous results may be justly apprehended. *Mild* alkalies in large doses should at once be administered in connection with some bland fixed oil. Lime liniment is usually upon the shelf already prepared, and valuable time may often be saved by at once giving it to the patient in large doses. Soap or either of the sodium carbonates in dilute solution may be given.

Official Inorganic Acids.

Name.	Sp. Gr.	Composition.
Hydracids.		
Acidum Hydrochloricum	1.163	31.9 per cent. HCl.
" Hydrochloricum Dilutum	1.050	10 per cent. HCl.
" Hydrobromicum Dilutum	1.077	10 per cent. HBr.
Oxyacids.		
Acidum Nitricum	1.414	68 per cent. HNO_3.
" Nitricum Dilutum	1.057	10 per cent. HNO_3.
" Nitro-Hydrochloricum		180 C.c. Nitric Acid. 820 C.c. Hydrochloric Acid.
" Nitro-Hydrochloricum Dilutum		40 C.c. Nitric Acid. 180 C.c. Hydrochloric Acid. 780 C.c. Distilled Water.
" Sulphuricum	1.835	92.5 per cent. H_2SO_4.
" Sulphuricum Dilutum	1.070	10 per cent. H_2SO_4.
" Sulphuricum Aromaticum	0.939	100 C.c. Sulphuric Acid. 50 C.c. Tincture of Ginger. 1 C.c. Oil of Cinnamon. 849 C.c. Alcohol.
" Sulphurosum	1.035	6.4 per cent. SO_2.
" Phosphoricum	1.710	85 per cent. H_3PO_4.
" Phosphoricum Dilutum	1.057	10 per cent. H_3PO_4.
" Hypophosphorosum Dilutum	1.046	10 per cent. HPH_2O_2.
Anhydrides or Oxides.		
Acidum Arsenosum		As_2O_3, Arsenous Oxide.
" Chromicum		CrO_3, Chromic Anhydride.

ACIDUM HYDROCHLORICUM. *U. S.* Hydrochloric Acid.

[MURIATIC ACID.]

A liquid composed of 31.9 per cent. by weight of absolute Hydrochloric Acid [HCl; 36.37] and 68.1 per cent. of water.

Preparation.—Hydrochloric acid, the only known compound of chlorine and hydrogen, is made on a very large scale both abroad and in this country. It is obtained most cheaply as a by-product resulting from the manufacture of soda-ash, by decomposing common salt heated to a high temperature with sulphuric acid. Sodium sulphate is formed, and gaseous hydrochloric acid is liberated. The latter is conducted into a tall tower filled with coke, called a coke-scrubber; the ascending gas is met by a descending flow of water, which trickles from a reservoir near the top. The gas readily dissolves in the water, and the relative quantities are so arranged that a strong solution passes out at the bottom of the tower. A purer product is formed by selecting the sodium chloride and sulphuric acid and using a series of stoneware jars shaped like Woulfe's bottles. About 120 parts of the salt require 100 parts of strong sulphuric acid. Two steps in the process are recognized. In the first reaction but one-half of the sodium chloride is decomposed, the decomposition of the remainder being effected at a temperature of 220° C. (428° F.) or over. The reaction is thus shown:

$$\underset{\substack{\text{Sodium}\\ \text{Chloride.}}}{2NaCl} + \underset{\substack{\text{Sulphuric}\\ \text{Acid.}}}{H_2SO_4} = \underset{\substack{\text{Hydrochloric}\\ \text{Acid.}}}{HCl} + \underset{\substack{\text{Sodium}\\ \text{Chloride.}}}{NaCl} + \underset{\substack{\text{Acid Sodium}\\ \text{Sulphate.}}}{NaHSO_4},$$

and the residue, when heated, yields the rest of the hydrochloric acid, as follows:

$$\underset{\text{Sodium Chloride.}}{NaCl} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} = \underset{\text{Hydrochloric Acid.}}{HCl} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4},$$

Hydrochloric acid, or, more properly, solution of hydrochloric acid, is used in pharmacy to make the official preparations of the diluted hydrochloric acid, nitrohydrochloric acid, and diluted nitrohydrochloric acid, in the preparation of chlorine water, chlorides, and many other compounds. The yellow color of the common acid is generally due to organic substances or a trace of iron; the white fumes produced when the acid is exposed to the air are caused by the gaseous acid combining with the moisture in the air, and also with a trace of ammonia usually present, forming ammonium chloride. The official description and tests are as follows:

Acidum Hydrochloricum. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A colorless, fuming liquid; fumes and odor disappear on diluting the Acid with 2 volumes of water. By heat it is completely volatilized. Sp. gr. 1.163.	Pungent, suffocating odor; intensely acid taste; strongly acid reaction.	Miscible, in all proportions, with water and alcohol.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On heating it, at first a stronger acid passes off, until, at 110° C. (230° F.), a liquid containing 20.18 per cent. of the absolute acid remains (specific gravity about 1.102 at 15° C.), which distils unchanged, leaving no residue, if the Acid was perfectly pure; heated with manganese dioxide, an abundance of chlorine gas is given off.	Thallium, Arsenic, Lead, etc.	When a few C.c. of freshly saturated hydrogen sulphide T.S. are poured carefully on top of an equal volume of the Acid, no color should develop at the zone of contact.
To neutralize 3.64 Gm. of the Acid, diluted with 10 C.c. of water, should require 31.9 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the *absolute acid*), phenolphtalein being used as indicator.	Iodine or Bromine.	A few drops of chloroform, added to 1 C.c. of the Acid diluted with 2 C.c. of water, should not become colored, either at once, or after the addition of a few drops of freshly prepared chlorine water, or of a granule of potassium chlorate.
	Copper.	With silver nitrate T.S. it yields a white, curdy precipitate, insoluble in nitric acid, but readily soluble in ammonia water, forming a colorless liquid.
	Iron, Aluminum, etc.	If 1 C.c. of the Acid be slightly supersaturated with ammonia water, and 1 C.c. of ammonium sulphide T.S. added, neither a color nor a turbidity should appear.
	Non-volatile impurities.	If 10 C.c. of the Acid be evaporated from a platinum or porcelain capsule, not more than a bare trace of residue should remain.
	Chlorine or Bromine.	If 1 C.c. of the Acid be diluted with 5 C.c. of water and 0.5 C.c. of zinc-iodide starch T.S. added, no blue color should appear.
	Sulphuric Acid.	If 1 C.c. of the Acid be diluted with 5 C.c. of water, and a few drops of barium chloride T.S. added, no precipitate or turbidity should appear within one hour.
	Sulphurous Acid.	Nor should the addition to the above mixture of a few drops of decinormal iodine V.S. produce any turbidity.
	Arsenic.	On adding 1 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), together with a small piece of pure tin-foil, to 1 C c. of the Acid, no coloration should occur within one hour.

Uses.—Hydrochloric acid is largely used in making chlorides and other preparations. Medicinally it is usually prescribed in a diluted form. The dose is five to ten minims (0.3 to 0.6 C.c.).

ACIDUM HYDROCHLORICUM DILUTUM. *U.S.* Diluted Hydrochloric Acid.

[DILUTED MURIATIC ACID.]

	Metric.	Old form.
Hydrochloric Acid	100 Gm.	5½ fl. oz.
Distilled Water	219 Gm.	14 fl. oz.
To make	319 Gm.	19½ fl. oz.

Mix them. Keep the product in glass-stoppered bottles.

A colorless liquid, containing 10 per cent. by weight of absolute hydrochloric acid. Specific gravity about 1.050.

The official test of strength is as follows:

To neutralize 3.64 Gm. of Diluted Hydrochloric Acid should require 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the absolute acid), phenolphtalein being used as indicator.

The tests for impurities are those of hydrochloric acid.

Uses.—Diluted hydrochloric acid is used as a refrigerant and tonic, in doses of fifteen to thirty minims (1 to 2 C.c.), largely diluted with water. It should be sucked through a glass tube or a straw, to avoid injury to the teeth.

ACIDUM HYDROBROMICUM DILUTUM. *U.S.* Diluted Hydrobromic Acid.

A liquid composed of 10 per cent., by weight, of absolute Hydrobromic Acid [$HBr = 80.76$], and 90 per cent. of Water.

Preparation.—Two methods are generally used for making this preparation,—one by distillation, the other by double decomposition and precipitation. The former method yields the purer product, the latter is the more convenient. For other methods of preparation, see U.S. Dispensatory, 17th ed., p. 51.

Diluted Hydrobromic Acid (*Distillation Process*).—Take of Potassium Bromide and Sulphuric Acid, each, 150 parts, Distilled Water, a sufficient quantity. Add the Sulphuric Acid to 25 parts of Distilled Water, and cool the mixture. Then dissolve the Potassium Bromide in 150 parts of water by the aid of heat, supplying the loss of water by evaporation during the heating. Carefully pour the diluted Sulphuric Acid into the hot solution with constant stirring, and set the mixture aside for twenty-four hours, in order that the Potassium Sulphate may crystallize. Pour off the liquid into a retort, break up the crystalline mass, transfer it to a funnel, and, having drained the crystals, drop slowly upon them 50 parts of cold Distilled Water so as to wash out the acid liquid. Add this liquid to that in the retort, and distil nearly to dryness at a moderate heat. If red fumes of bromine are given off during any stage of the distillation, change the receiver

as soon as such fumes cease to appear. Finally determine in the distillate the amount of actual Hydrobromic Acid (8.08 Gm. should require 10 C.c. of normal potassium hydrate V.S.), and add to the remaining weighed distillate such an amount of cold Distilled Water as shall cause the finished acid to contain 10 per cent. of actual Hydrobromic Acid.

This process is based upon that proposed by Dr. E. R. Squibb, the acid preferred by him having, however, the strength of 34 per cent. instead of 10 per cent.

$$\underset{\text{Potassium Bromide.}}{KBr} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Acid Potassium Sulphate.}}{KHSO_4} + \underset{\text{Hydrobromic Acid.}}{HBr.}$$

Diluted Hydrobromic Acid (Precipitation Process).—Dissolve 340 grains of Potassium Bromide in 4 fluidounces of Water, add 400 grains of Tartaric Acid to the solution, cool the mixture to 40° F., allowing it to stand without agitation as long as possible before pouring off the clear solution from the precipitated acid Potassium Tartrate. If it can be kept in a cool place for several weeks before it is used, it will be improved; it will contain about 10 per cent. of absolute hydrobromic acid. This method is a modification of Wade's and Fothergill's processes, and has the advantage of separating the acid potassium tartrate more effectually. The crystals which form upon the bottom and sides of the bottle act as nuclei, and in time serve to abstract all of the acid tartrate from the liquid.

Acidum Hydrobromicum Dilutum. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A clear, colorless liquid. By heat completely volatilized. Sp. gr. 1.077.	Odorless; strongly acid taste; acid reaction.	Miscible in all proportions with water and alcohol.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
On distilling it, water and weak acid first pass over. When the temperature of 126° C. (258.8° F.) is reached, an acid of 47.8 per cent. remains, which may be distilled unchanged.	Bromine.	On being kept for some time, the Acid should not become colored.
On adding an equal volume of chlorine water to Diluted Hydrobromic Acid, bromine is liberated, which is soluble in chloroform, imparting to this liquid a yellow color, indicating absence of *iodine*. Silver nitrate T.S. causes a yellowish-white precipitate, somewhat soluble in hydrobromic acid, insoluble in diluted nitric acid, very slightly soluble in ammonia water, but more soluble in stronger ammonia water. Copper sulphate T.S. produces a deep-red color upon addition of sulphuric acid.	Sulphuric Acid.	Barium chloride T.S. should not produce a turbidity or precipitate.
To neutralize 8.08 Gm. of Diluted Hydrobromic Acid should require 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the absolute acid), phenophtalein being used as indicator.	Arsenic.	If 1 C.c. of the Acid be mixed with 1 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no brown coloration should appear within half an hour.

Uses.—Diluted hydrobromic acid is used as a nervine and hypnotic, in doses of two fluidrachms (7.4 C.c.).

ACIDUM NITRICUM. *U. S.* Nitric Acid.

A liquid composed of 68 per cent., by weight, of absolute Nitric Acid [HNO_3 = 62.89], and 32 per cent. of Water.

Nitric Acid should be kept in dark amber-colored, glass-stoppered bottles.

Preparation.—Nitric acid is prepared from N_2O_5, one of the five compounds of nitrogen and oxygen: these are nitrogen monoxide, or hyponitrous oxide (laughing gas), N_2O; nitrogen dioxide, N_2O_2 or $(NO)_2$; nitrous oxide, N_2O_3; nitrogen tetroxide or peroxide, N_2O_4; and nitric oxide, N_2O_5. From this latter, by the addition of water, nitric acid is formed: $N_2O_5 + H_2O = (HNO_3)_2$. Nitric acid is prepared commercially by reacting on sodium nitrate or Chili saltpetre with sulphuric acid. Sodium nitrate is preferred as the source, because it is cheaper than potassium nitrate, and, in addition, it affords a larger yield of nitric acid. If two molecules of the sodium salt and one of sulphuric acid be taken, the reactions will be as follows:

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} + \underset{\text{Nitric Acid.}}{HNO_3}.$$

Then, by raising the heat, the acid sodium sulphate acts upon the second molecule of sodium nitrate:

$$\underset{\text{Sodium Nitrate.}}{NaNO_3} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Nitric Acid.}}{HNO_3}.$$

The specific gravity of the official acid, or, as it is technically termed, 43° acid, is 1.414. That which is usually furnished in commerce is not so strong as this, but has the specific gravity of 1.355, and is known as 38° acid. Care should always be observed to specify, in ordering from the manufacturing chemist or dealer, the specific gravity of the acid desired; for if preparations are to be made like the official solutions of iron, success cannot be expected if acids of official strength are not used. The reddish acid, called *nitrous acid*, is nitric acid containing more or less nitrogen tetroxide (N_2O_4). The same acid may be formed by impregnating nitric acid with nitrogen dioxide (N_2O_2).

Acidum Nitricum. U. S.	Odor, Taste, and Reaction.	Solubility.
A colorless, fuming, very caustic and corrosive liquid. Sp. gr. 1.414.	Peculiar, somewhat suffocating odor; strongly acid.	Miscible, in all proportions, with water or alcohol.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
It boils at 120.5° C. (248.9° F.), and is completely volatilized. It dissolves copper, mercury, silver, and other metals with evolution of red vapors, and stains woollen fabrics and animal tissues a bright yellow. Heated with indigo T.S., it discharges the blue color of the latter.	Iron or much Lead.	If 1 C.c. of Nitric Acid be treated with a slight excess of ammonia, no precipitate should be formed.
	Copper.	The liquid should not have a blue tint.
	Lead, Iron, Copper, etc.	The further addition of 2 drops of ammonium sulphide T.S. should not cause a black precipitate.
	Sulphuric Acid.	A portion diluted with 5 volumes of water should afford no precipitate with barium chloride T.S.
	Hydrochloric Acid.	Or with silver nitrate T.S.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
To neutralize 3.145 Gm. of Nitric Acid should require 34 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 2 per cent. of absolute acid), phenolphtalein being used as indicator.	Lead, Arsenic, Copper.	On diluting some of the Acid with 5 times its volume of water, a portion of this liquid, when gently heated and treated with freshly prepared hydrogen sulphide T.S., should not show a colored precipitate.
	Iodine or Bromine.	If the diluted Acid be shaken with a few drops of chloroform, the latter should remain colorless.
	Iodic Acid or Bromic Acid.	After the introduction of a small piece of metallic zinc to the above mixture, no color should be developed.

Uses.—Nitric acid, sometimes called *aqua fortis*, is used in pharmaceutical operations to form nitrates and as an oxidizing agent. Free nitric acid, however, will evolve oxygen at a red heat, according to the following reaction:

$$\underset{\text{Nitric Acid.}}{4HNO_3} = \underset{\substack{\text{Nitrogen}\\ \text{Tetroxide.}}}{(N_2O_4)_2} + \underset{\text{Oxygen.}}{O_2} + \underset{\text{Water.}}{(H_2O)_2}$$

It oxidizes sulphur and phosphorus, giving rise to sulphuric and phosphoric acids, and all the metals, with a few exceptions. It combines with salifiable bases and forms nitrates. Medicinally, nitric acid, when taken internally in doses of five to ten minims (0.3 to 0.6 C.c.), largely diluted, is tonic, antiseptic, and astringent; when applied to the skin it is escharotic, producing a yellow stain, due to the formation of *xanthoproteic acid.*

ACIDUM NITRICUM DILUTUM. *U. S.* Diluted Nitric Acid.

	Metric.	Old form.
Nitric Acid	100 Gm.	4 fl. oz.
Distilled Water	580 Gm.	29 fl. oz.
To make	680 Gm.	about 2 pints.

Mix them. Keep the product in dark amber-colored, glass-stoppered bottles.

Diluted nitric acid contains about 14.3 per cent. of official nitric acid, corresponding to 10 per cent. of absolute nitric acid. Sp. gr. 1.057. The official test of strength is that 6.29 Gm. of diluted nitric acid should require 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of absolute acid), phenolphtalein being used as indicator.

Uses.—It is used medicinally for the same purposes as the strong nitric acid; when taken internally, the dose is twenty minims (1.2 C.c.).

ACIDUM NITROHYDROCHLORICUM. *U. S.* Nitrohydrochloric Acid.

[Nitromuriatic Acid.]

	Metric.	Old form.
Nitric Acid	180 C.c.	3 fl. oz.
Hydrochloric Acid	820 C.c.	13½ fl. oz.
To make	1000 C.c.	16½ fl. oz.

Mix the Acids in a capacious glass vessel, and, when effervescence has ceased, pour the product into dark amber-colored, glass-stoppered

bottles, which should not be more than half filled, and keep them in a cool place.

When nitric acid is mixed with hydrochloric acid, mutual decomposition takes place, according to the reaction

$$\underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Hydrochloric Acid.}}{3HCl} = \underset{\text{Nitrosyl Chloride.}}{NOCl} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O},$$

and a liquid is formed, capable of dissolving gold, called *aqua regia.*

The value of this acid depends upon the completion of the above reaction and the production of nitrosyl chloride and free chlorine. It should be kept in a cool dark place, on account of its liability to lose chlorine by heat, and to have its chlorine converted into hydrochloric acid by the action of light and the decomposition of water. On account of its tendency to decomposition, it should not be made in large quantities, nor be kept on hand very long; care should be taken not to transfer it to the bottle in which it is to be dispensed, until effervescence has ceased, lest the pressure within should drive out the stopper or cause the bottle to explode violently.

Nitrohydrochloric acid is a golden-yellow, fuming, and very corrosive liquid, having a strong odor of chlorine and a strongly acid reaction. By heat it is wholly volatilized. It readily dissolves gold leaf, and a drop added to potassium iodide T.S. liberates iodine abundantly.

Uses.—Nitrohydrochloric acid, or, as it is still called, nitromuriatic acid, is given internally in hepatic affections, in doses of three minims (0.18 C.c.) and upwards, well diluted with water. Great care should be taken in dispensing this acid, particularly if directed in combination with infusions, tinctures, etc.: the reaction occurring upon mixing should be permitted to cease entirely before dispensing, to avoid the possibility of an explosion taking place when the preparation is in the patient's hands.

ACIDUM NITROHYDROCHLORICUM DILUTUM. *U. S.* Diluted Nitrohydrochloric Acid.

[DILUTED NITROMURIATIC ACID.]

	Metric.	Old form.
Nitric Acid	40 C.c.	1 fl. oz.
Hydrochloric Acid	180 C.c.	4½ fl. oz.
Distilled Water	780 C.c.	19½ fl oz.
To make	1000 C.c.	25 fl. oz.

Mix the Acids in a capacious glass vessel, and, when effervescence has ceased, add the Distilled Water. Keep the product in dark amber-colored, glass-stoppered bottles, in a cool place.

Diluted nitrohydrochloric acid is a colorless or faintly yellow liquid, odorless or having a faint odor of chlorine, and a very acid taste and reaction. By heat it is wholly volatilized. On adding a few drops to potassium iodide T.S., iodine is liberated.

It should be made strictly according to the official directions. The acids must be mixed whilst concentrated, otherwise the nitrosyl chloride and chlorine are not produced. Hence the "rapid method," so frequently used, of mixing the acids and immediately diluting with water, does not produce an official preparation, and is reprehensible in practice.

Uses.—Diluted nitrohydrochloric acid is given in doses of ten minims (0.6 C.c.), properly diluted, as a tonic and stimulant to the liver.

ACIDUM SULPHURICUM. *U.S.* Sulphuric Acid.

A liquid composed of not less than 92.5 per cent., by weight, of absolute Sulphuric Acid [$H_2SO_4 = 97.82$], and not more than 7.5 per cent. of water.

The above-named percentage (92.5) is that assumed for Sulphuric Acid in the formulas of pharmacopœial preparations.

Sulphuric Acid should be kept in glass-stoppered bottles.

Preparation.—Sulphuric acid is obtained by burning sulphur or iron pyrites, FeS_2, and allowing the product of combustion, SO_2, to mix with nitrous fumes obtained from the decomposition of sodium nitrate, which change SO_2 into SO_3, and this uniting with steam yields H_2SO_4. If the sulphur were burned by itself, the product would be sulphurous oxide, which contains only two-thirds as much oxygen as sulphuric oxide. The object of the sodium nitrate is to furnish, by its decomposition, the requisite additional quantity of oxygen. To understand the process, it is necessary to remember that several of the oxides of nitrogen have oxidizing power. The reactions are thus expressed:

$$\underset{\text{Sulphurous Oxide.}}{2SO_2} + \underset{\text{Nitrogen Tetroxide.}}{N_2O_4} = \underset{\text{Sulphuric Oxide.}}{2SO_3} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2};$$

then

$$\underset{\text{Nitrogen Dioxide.}}{N_2O_2} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Nitrogen Tetroxide.}}{N_2O_4};$$

then

$$\underset{\text{Sulphuric Oxide.}}{SO_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Sulphuric Acid.}}{H_2SO_4};$$

in which the sulphurous oxide, from the burning pyrites or sulphur, is oxidized to sulphuric oxide by the nitrogen tetroxide, which readily parts with two atoms of oxygen to such bodies as sulphurous oxide, and then takes two atoms of oxygen again from the atmosphere, regenerating the original tetroxide. The nitrogen tetroxide thus acts simply as a carrier of atmospheric oxygen, whereby the SO_2 is changed into SO_3. This latter compound then unites with steam to form H_2SO_4, the final product.

This acid is made on an immense scale, the reactions taking place in leaden chambers. Sulphur is used most largely in the United States as the source of production, whilst pyrites are used almost exclusively abroad. As the latter nearly always contain arsenical compounds, the foreign commercial product is contaminated with them.

Acidum Sulphuricum. *U.S.*	Odor, Taste, and Reaction.	Solubility.
A colorless liquid, of an oily consistence. Sp. gr. not below 1.835.	Inodorous; strongly caustic and corrosive; strongly acid reaction.	In water and alcohol in all proportions, with evolution of so much heat that the mixing requires great caution.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
It boils at 338° C. (640.4° F.). When heated on platinum foil, it is vaporized without leaving a residue. If the Acid be dropped upon sugar or wood, it blackens them; if diluted with 5 volumes of water, the liquid yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. To neutralize 0.489 Gm. of Sulphuric Acid, diluted with about 10 C.c. of water, should require not less than 9.25 C.c. of normal potassium hydrate V.S. (each 0.1 C.c. corresponding to 1 per cent. of the absolute acid), phenolphtalein being used as indicator.	Lead.	On pouring the Acid into 4 or 5 volumes of alcohol, no precipitate should be formed within one hour.
	Nitric or Nitrous Acid.	If there be carefully poured upon Sulphuric Acid, in a test-tube, a layer of ferrous sulphate T.S., no brownish or reddish zone should appear at the line of contact of the two liquids.
	Hydrochloric Acid.	When diluted with 20 volumes of water, no precipitate should be formed by the addition of silver nitrate T.S.
	Lead, Arsenic, Copper.	When diluted with 20 volumes of water, no precipitate should be formed by the addition of hydrogen sulphide T.S.
	Iron.	When diluted with 20 volumes of water, no precipitate should be formed by the addition of an excess of ammonia water.
	Arsenic.	If 1 C.c. of a mixture of 1 volume of the Acid with 2 volumes of water be mixed with 1 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no coloration should appear within one hour.
	Non-volatile Impurities.	When diluted with 20 volumes of water containing excess of ammonia water, no fixed residue should be left on evaporation and gentle ignition.
	Iron, Thallium, etc.	Nor should the Acid thus supersaturated yield any precipitate on addition of ammonium sulphide T.S.
	Sulphurous or Nitrous Acid.	When considerably diluted and treated with test-zinc, it evolves a gas which should not blacken paper moistened with test-solution of nitrate of silver. If 1 C.c. of the Acid be diluted with 5 C.c. of water and cooled, the solution should not at once discharge the color of 0.1 C.c. of decinormal potassium permanganate V.S.

Uses.—Sulphuric acid is the most powerful of the official inorganic acids. It is employed in making many preparations, mostly on account of its energetic action in decomposing salts, and the large use made of its compounds with metals, alkaloids, and other bodies. It is rarely used in the pure state as an escharotic, owing to its tendency to spread. When accidentally dropped upon the skin, a quick and profuse application of magnesia will prove effective. Unless the quantity of acid is very small, care should be used in applying water, except when a very large quantity can be applied at once, as the amount of heat produced when water is mixed with sulphuric acid would increase the pain. Internally, sulphuric acid is administered either in its diluted form or as aromatic sulphuric acid.

ACIDUM SULPHURICUM AROMATICUM. *U.S.* Aromatic Sulphuric Acid.

	Metric.	Old form.
Sulphuric Acid	100 C.c.	3 fl. oz. 96 min.
Tincture of Ginger	50 C.c.	1 fl. oz. 288 min.
Oil of Cinnamon	1 C.c.	15 minims.
Alcohol, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Add the Sulphuric Acid gradually, and with great caution, to 700 C.c. [old form 22½ fl. oz.] of Alcohol, and allow the mixture to cool. Then add to it the Tincture of Ginger and the Oil of Cinnamon, and afterwards enough Alcohol to make the whole measure 1000 C.c. [old form 2 pints]. Keep the product in glass-stoppered bottles.

If 4.89 Gm. of Aromatic Sulphuric Acid be mixed, in a small flask, with 15 C.c. of water and boiled for several minutes (so as to decompose the ethyl-sulphuric acid), and the liquid be then allowed to cool, it should require, for complete neutralization, about 18.5 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of absolute or about 1.08 per cent. of official Sulphuric Acid), phenolphtalein being used as indicator. Aromatic Sulphuric Acid contains about 20 per cent., by weight, of official sulphuric acid, partly in form of ethyl-sulphuric acid; the specific gravity is about 0.939.

Uses.—This preparation, known as *elixir of vitriol*, and largely used, is employed principally as a remedy in the night-sweats of phthisis. It is used somewhat as an excipient for quinine pills, to reduce their size and render them more soluble. The introduction of the acid sulphate of quinine has diminished this use. Its employment in the preparation of infusion of cinchona is to aid in the extraction of the alkaloids. The dose is from 10 to 30 minims (0.6 to 1.9 C.c.).

ACIDUM SULPHURICUM DILUTUM. *U.S.* Diluted Sulphuric Acid.

	Metric.	Old form.
Sulphuric Acid	100 Gm.	1 fl. oz.
Distilled Water	825 Gm.	15 fl. oz.
To make	925 Gm.	16 fl. oz.

Pour the Acid gradually, under constant stirring, into the Distilled Water. Keep the product in glass-stoppered bottles. Diluted Sulphuric Acid contains 10 per cent., by weight, of absolute Sulphuric Acid, and has the specific gravity of about 1.070. To neutralize 4.89 Gm. of Diluted Sulphuric Acid should require 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the absolute acid), phenolphtalein being used as an indicator.

The strong acid is added gradually to the water, to guard against the too sudden production of heat, which might cause the fracture of a glass vessel. During the dilution, when commercial sulphuric acid is used, the liquid becomes slightly turbid, and in the course of a few days deposits a grayish-white powder, which is lead sulphate, and from which the diluted acid should be poured off.

The formation of this precipitate does not occur if official or chemically pure sulphuric acid is used. The lead salt is present only in sulphuric acid which has not been purified.

Uses.—Diluted sulphuric acid has the same properties as the acid from which it is made, except those which are dependent upon the strength of the latter. It is given internally, properly diluted, in doses of ten to twenty minims (0.6 to 1.2 C.c.).

ACIDUM SULPHUROSUM. *U.S.* Sulphurous Acid.

A liquid composed of not less than 6.4 per cent., by weight, of Sulphurous Acid Gas [Sulphur Dioxide, $SO_2 = 63.9$], and not more than 93.6 per cent. of water.

	Metric.	Old form.
Sulphuric Acid	80 C.c.	2 fl. oz. 269 min.
Charcoal, in coarse powder	20 Gm.	292 grains.
Distilled Water	1000 C.c.	2 pints.

Introduce the Charcoal into a glass flask having a capacity of about 500 C.c. [old form 1 pint], add the Acid, and mix them well. By means of a glass tube and well-fitting corks, connect the flask with a wash-bottle of the capacity of about 200 C.c. [old form 6½ fl. oz.], which is one-third filled with water and fitted with a cork having three perforations. Into one of these perforations insert a safety-tube, which should reach nearly to the bottom of the bottle; into the remaining perforation fit a glass tube, and connect it with a bottle having a capacity of about 1500 C.c. [old form 3 pints] and containing 1000 C.c. [old form 2 pints] of Distilled Water deprived of air by being boiled shortly before use. The tube should dip about twenty-five millimeters below the surface of the Distilled Water. By means of a second tube connect this bottle with another containing a dilute solution of sodium carbonate, to absorb any gas which may not be retained by the Distilled Water. Having ascertained that all the connections are air-tight, apply a moderate heat to the flask containing the Sulphuric Acid and Charcoal, until the evolution of gas has nearly ceased, and, during the passage of the gas, keep the bottle containing the Distilled Water at or below 10° C. (50° F.), by surrounding it with cold water or ice. Finally pour the Sulphurous Acid into dark amber-colored, glass-stoppered bottles, and keep them in a cool place, protected from light.

The reactions which take place are simple. When the sulphuric acid (H_2SO_4) and charcoal are heated together, two molecules of the former each give up an atom of oxygen to the latter, and there are thus produced sulphurous and carbonic acid gases, which, having been first passed through a wash-bottle containing a little water to absorb impurities, are received into the distilled water, where the sulphurous acid is absorbed, whilst the greater part of the carbonic acid gas escapes.

$$\underset{\text{Sulphuric Acid.}}{4H_2SO_4} + \underset{\text{Carbon.}}{C_2} = \underset{\text{Sulphurous Acid.}}{4SO_2} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{4H_2O.}$$

The mounted flask figured on page 149 is well adapted for preparing sulphurous acid (the thermometer may be omitted). The wash-bottle illustrated upon page 206 can be used in lieu of the bottle directed in the official formula: as the generation of the gas progresses, the liquid in the wash-bottle accumulates. Care must be observed in making sulphurous acid to disconnect the wash-bottle from the tube leading to the flask the instant the gas ceases to come over, otherwise a portion of the liquid in the wash-bottle will be sucked into the flask by the partial vacuum produced, almost certainly involving fracture of the flask.

Acidum Sulphurosum. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A colorless liquid, of sp. gr. not less than 1.035.	Characteristic odor of burning sulphur; very acid sulphurous taste; strongly acid reaction.	Miscible, in all proportions, with water and alcohol.

Test for Identity and Quantitative Test.	Impurities.	Test for Impurities.
By heat it is completely volatilized. Litmus paper brought in contact with the Acid is at first turned red, and afterward bleached. On gently heating a few C.c. of the Acid in a test-tube, the gas evolved will blacken a strip of paper moistened with mercurous nitrate T.S., but will not affect one moistened with lead acetate T. S. On pouring 1 C.c. of Sulphurous Acid into a test-tube containing 5 C.c. of diluted hydrochloric acid and adding a small piece of pure zinc, hydrogen sulphide gas is evolved, which blackens paper wet with lead acetate T.S. If 2 Gm. of Sulphurous Acid be diluted with 25 C.c. of distilled water and a little starch T.S. be added, at least 40 C.c. of decinormal iodine V.S. should be required, before a permanent blue tint is developed (each C.c. corresponding to 0.16 per cent. of Sulphur Dioxide).	Limit of Sulphuric Acid.	If to 10 C.c. of Sulphurous Acid there be added 1 C.c. of diluted hydrochloric acid, followed by 1 C.c. of barium chloride T.S., not more than a very slight turbidity should be produced.

The official quantitative test depends for its action upon the decomposition of a quantity of iodine proportionate to the amount of sulphurous acid present in the sample tested. The iodine is converted into hydriodic acid, which is colorless, whilst the sulphurous acid becomes sulphuric acid: thus, $H_2SO_3 + I_2 + H_2O = 2HI + H_2SO_4$. The gelatinized starch is used simply to show, by the blue color which it assumes, when free iodine is present: this takes place when all the sulphurous acid has been decomposed.

Uses.—Sulphurous acid is principally used to prevent the growth of the microscopic organisms which induce fermentation. Internally, it is rarely administered, its salts, the sulphites, being preferred. The dose is from three minims to one fluidrachm (0.18 to 3.7 C.c.) diluted with water.

ACIDUM PHOSPHORICUM. *U. S.* Phosphoric Acid.

A liquid composed of not less than 85 per cent., by weight, of absolute Orthophosphoric Acid [$H_3PO_4 = 97.8$], and not more than 15 per cent. of water.

The above-mentioned percentage (85) is that assumed for Phosphoric Acid in the formulas of pharmacopœial preparations. Phosphoric Acid should be kept in glass-stoppered bottles.

This concentrated form of phosphoric acid is now of the strength of 85 per cent., instead of 50 per cent., as in the U. S. P. 1880.

The process for making phosphoric acid was abandoned by the U. S. P. 1890 on account of the danger usually attending the operation, and because it can be made much more profitably on the large scale.

A modification of this process, which obviates any likelihood of danger, is as follows: Pour 12 fluidounces of distilled water, mixed

with 11 fluidounces of nitric acid, into a two-pint flask. Add 40 grains of bromine, and shake it gently until it is dissolved. Now add two ounces of phosphorus, and set the flask aside, where the nitrous vapors may be carried off without injury. In winter-time, or if the acid is needed at once, it will be necessary to aid the reaction by a gentle heat; but if sufficient time can be allowed, the phosphorus will disappear gradually at the ordinary temperature, and no particular attention will be needed until the phosphorus is oxidized. The nearly colorless liquid remaining in the flask is then evaporated, tested for impurities by the official method, and diluted to the proper strength.

The most dangerous impurity likely to be found in the finished preparation is arsenic,—its presence being traced to the sulphuric acid made from pyrites, which is used in making the phosphorus.

Acidum Phosphoricum. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A colorless liquid, of the specific gravity not below 1.710.	Odorless; strongly acid taste; acid reaction.	Miscible, in all proportions, with water and alcohol.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
When heated, the liquid loses water, and when a temperature of about 200° C. (392° F.) has been reached, the Acid is gradually converted into pyrophosphoric and metaphosphoric acids, which may be volatilized in dense fumes at a red heat, or forms on cooling a transparent mass of glacial Phosphoric Acid. If the Acid be supersaturated with ammonia water, addition of magnesium sulphate T.S. (or of magnesia mixture) produces a white, crystalline precipitate. If this precipitate be dissolved in diluted acetic acid, the solution yields a yellow precipitate with silver nitrate T.S.	Phosphorous Acid.	If 1 C.c. of Phosphoric Acid be diluted with 5 C.c. of water, and gently warmed, it should not be blackened by silver nitrate T.S., nor be turned white or whitish by mercuric chloride T.S.
0.978 Gm. of Phosphoric Acid, diluted with water, should require, for neutralization, not less than 17 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 5 per cent. of the absolute acid), phenolphtalein being used as indicator.	Arsenic.	If 1 C.c. of the Acid (in which nitric and Phosphorous acids have previously been shown to be absent) be mixed with 1 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no coloration should appear within one hour.
	Nitric Acid.	If a crystal of ferrous sulphate be dropped into a cooled mixture of 1 C.c. each of Phosphoric and sulphuric acids, no brown or brownish-black color should appear around the crystal.
	Phosphate.	Upon adding to 1 C.c. of the Acid a mixture of 3 C.c. of alcohol and 1 C.c. of ether, no turbidity should appear.
	Sulphuric Acid.	After diluting Phosphoric Acid with 5 volumes of distilled water, no precipitate should be produced on the addition of small portions of barium chloride T.S.
	Iron.	After neutralizing a portion of the Acid with ammonia water, the addition of ammonium sulphide T.S. should produce neither a color nor a precipitate.
	Hydrochloric Acid.	The diluted acid should yield no precipitate with silver nitrate T.S.
	Pyrophosphoric and Metaphosphoric Acids.	Nor should any precipitate be formed, after several hours, by the addition of an equal volume of tincture of ferric chloride.

Uses.—Phosphoric acid, sometimes called "syrupy phosphoric acid," is used almost solely to make the diluted phosphoric acid.

ACIDUM PHOSPHORICUM DILUTUM. *U. S.* **Diluted Phosphoric Acid.**

	Metric.	Old form.
Phosphoric Acid	100 Gm.	$1\frac{1}{4}$ fl. oz.
Distilled Water	750 Gm.	16 fl. oz.
To make	850 Gm.	$17\frac{1}{4}$ fl. oz.

Mix them. Keep the product in well-stoppered bottles.

Diluted Phosphoric Acid has a specific gravity of 1.057, and contains 10 per cent. by weight of orthophosphoric acid. It should respond to the tests of purity required for Phosphoric Acid. 4.89 Gm. of Diluted Phosphoric Acid should require for neutralization 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the absolute acid), phenolphtalein being used as indicator.

The precipitation which sometimes occurs when this acid is mixed with tincture of ferric chloride is generally due to the presence of pyrophosphoric acid. Ferric pyrophosphate is precipitated in the form of an insoluble gelatinous precipitate.

Uses.—Diluted phosphoric acid is tonic and refrigerant in doses of twenty minims (1.2 C.c.).

ACIDUM HYPOPHOSPHOROSUM DILUTUM. *U. S.* **Diluted Hypophosphorous Acid.**

A liquid composed of about 10 per cent., by weight, of absolute Hypophosphorous Acid [HPH_2O_2 = 65.88] and about 90 per cent. of water. Specific gravity: about 1.046 at 15° C. (59° F.).

Diluted hypophosphorous acid may be made in various ways, but the process of the National Formulary (see Part VI.), which consists of decomposing potassium hypophosphite with tartaric acid, is practical. The trace of acid potassium tartrate left in the solution is insufficient to be considered objectionable when used medicinally.

Acidum Hypophosphorosum Dilutum. *U. S.*	Odor, Taste, and Reaction.	Solubilities.	
		Water.	Alcohol.
A colorless liquid. When heated in a porcelain capsule, it evaporates, losing at first principally water and becoming more concentrated. On further heating it decomposes, forming hydrogen phosphide, which ignites, and phosphoric acid. The pasty residue finally reddens, ignites, and the last portions of phosphorus burn out at higher heat. Sp. gr. 1.046.	Odorless; acid reaction.	In all proportions.	In all proportions.

Tests for Identity and Qualitative Tests.	Impurities.	Tests for Impurities.
From silver nitrate T.S. it reduces black metallic silver.	Lead.	The addition of hydrogen sulphide T.S. to the Acid should produce neither a precipitate nor a coloration.
When the Acid is gently heated with copper sulphate T.S., a yellow precipitate of copper hydride falls, which rapidly assumes a reddish-brown color.	Iron.	If some of the Acid be neutralized with ammonia water, separate portions of the liquid should not yield a precipitate with ammonium sulphide T.S.

Tests for Identity and Qualitative Tests.	Impurities.	Tests for Impurities.
If 0.5 Gm. of the Diluted Hypophosphorous Acid be mixed with 7 C.c. of sulphuric acid and 35 C.c. of decinormal potassium permanganate V.S., and the mixture boiled for fifteen minutes, it should require about 4.7 C.c. of decinormal oxalic acid V.S. to discharge the red color, corresponding to about 10 per cent. of absolute Hypophosphorous Acid.	Calcium.	If some of the Acid be neutralized with ammonia water, separate portions of the liquid should not yield a precipitate with ammonium oxalate T.S.
To neutralize 6.6 Gm. of Diluted Hypophosphorous Acid should require about 10 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to 1 per cent. of the absolute acid), phenolphtalein being used as an indicator.	Phosphoric, Sulphuric, Oxalic, and Tartaric Acids.	If some of the Acid be neutralized with ammonia water, separate portions of the liquid should not yield a slight turbidity with barium chloride T.S.
	Potassium.	Neither platinic chloride T.S. nor sodium cobaltic nitrite T. S. should produce more than a slight yellow turbidity in the diluted Acid.

Uses.—This acid was introduced into the U. S. P. 1890 solely for the purpose of acting as a reducing agent, when added to solutions of various iodides which are liable to be decomposed by the action of light and air. (See Syrupus Acidi Hydriodici, Liquor Ferri Iodidi, N. F.)

QUESTIONS ON CHAPTERS XXXII. AND XXXIII.

HYDROGEN, OXYGEN, WATER, AND INORGANIC ACIDS.

What are the atomic weights of hydrogen? Of oxygen? Of water?
Give a description of hydrogen. Of oxygen.
What percentage of oxygen by weight does water contain?
What is the formula in symbols of water? How may metallic impurities be detected?
If the transparency or color of distilled water is affected by any of the following tests, what impurity is indicated?—viz.: Hydro-sulphuric acid or ammonium sulphide; test solution of barium chloride; test solution of silver nitrate; test solution of ammonium oxalate; test solution of mercuric chloride, with or without the subsequent addition of potassium carbonate.
What are the uses of distilled water in pharmacy?
What is the Latin official name of solution of hydrogen dioxide?
When freshly prepared, how much pure hydrogen dioxide does it contain?
To what amount of available oxygen does this correspond?
How is it prepared?
How are acids distinguished from other bodies?
What do the suffixes "ous" and "ic" designate when applied to acids?
How may glass stoppers be removed without injury from bottles in which they have become tightly fastened?
Why should corks not be used as stoppers for strong acids?
How may carboys containing strong acids be handled conveniently and safely?
What grades of acid are found in commerce?
What injurious results may follow the use of weak and impure acids?
Are the official inorganic acids uniform in strength?
What is the strength of hydrochloric acid? Of nitric acid? Of sulphuric acid?

Are the diluted acids uniform in strength?
What per cent. of absolute acid do they contain?
What are the medical properties of the inorganic acids?
How may their injurious action on the teeth be avoided?
What are the proper antidotes for strong acids which may have been taken in poisonous doses?
Give the formula in symbols and molecular weight of hydrochloric acid.
What is official hydrochloric acid? How is it made?
Explain the reaction which takes place in its manufacture.
For what purposes in pharmacy is hydrochloric acid used?
To what is the yellow color of the common acid usually due?
What is the cause of the white fumes which are produced when the acid is exposed to the air?
What are tests for the following impurities?—viz.: Iron or much lead; copper; lead and iron; non-volatile metals; chlorine; sulphuric acid; sulphurous or arsenous acid.
What is the specific gravity of hydrochloric acid?
Give the formula for diluted hydrochloric acid
How much absolute hydrochloric acid does it contain?
What is the official test of its strength? What are its uses?
What is the composition of diluted hydrobromic acid?
Give the formula in symbols and molecular weight of diluted hydrobromic acid.
How is diluted hydrobromic acid usually made? Describe the distillation process.
Explain the chemical reaction. Describe the precipitation process.
What chemical reaction takes place in this process?
What is the specific gravity of diluted hydrobromic acid?
How may free bromine be detected? How may sulphuric acid be detected?
For what is diluted hydrobromic acid used, and what is the dose?
Give the symbol and molecular weight of absolute nitric acid.
How much is contained in official nitric acid?
What five compounds are there of nitrogen and oxygen?
From which of these is nitric acid formed, and how?
How is nitric acid prepared commercially?
If two molecules of the sodium salt and one of sulphuric be used, what will be the reaction? Upon raising the heat, what further reaction takes place?
What is the specific gravity of the official acid? Of the commercial acid?
What is the composition of the reddish acid called nitrous acid?
What are tests for the following impurities?—viz.: Iron or much lead; copper; lead and iron; non-volatile metals; sulphuric acid; hydrochloric acid; arsenic acid; free iodine; iodic acid.
For what is nitric acid used in pharmaceutical operations?
Explain the decomposition which takes place when nitric acid is exposed to a red heat. What acids are produced by its action on phosphorus and sulphur?
What does it form in combination with salifiable bases?
What are its medicinal properties?
To what is the yellow stain due when nitric acid is applied to the skin?
Give the formula for diluted nitric acid. How much real nitric acid does it contain?
What is its specific gravity? What is the officinal test of its strength?
What is its medicinal use and dose?
Give the formula for nitrohydrochloric acid.
What reaction takes place when nitric acid is mixed with hydrochloric acid?
What is the liquid thus formed popularly called?
Upon what does the value of this acid depend?
Why should it be kept in a cool and dark place? Describe its physical properties.
What is its medicinal use? What is the dose?
Why is especial care necessary in dispensing this acid?
Give the formula for diluted nitrohydrochloric acid.
Should the ingredients be all mixed together at once? Why?
Describe its physical properties. What are its medicinal uses and dose?
Give the symbol and molecular weight of absolute sulphuric acid.
How much does the official sulphuric acid contain?
How is sulphuric acid obtained?
Explain the reactions that take place in the process.
What is the principal source of production of sulphuric acid in America? What in Europe? What is the foreign commercial article apt to be contaminated with?

What is the specific gravity of the official acid?
What are the tests for the following impurities?—viz.: Lead; nitric acid; hydrochloric acid; copper, iron; non-volatile metals; arsenous or sulphurous acid.
What are its uses?
How is it administered internally?
Give the formula for aromatic sulphuric acid.
How much official sulphuric acid does it contain?
What is its specific gravity? What is its popular name?
What are its uses? What is the dose?
Give the formula for diluted sulphuric acid.
How much official sulphuric acid does it contain?
What is its specific gravity?
When commercial sulphuric acid is diluted, what precipitate is thrown down, and why?
What are the uses of sulphuric acid? What is the dose?
Give the formula in symbols and molecular weight of sulphurous acid gas?
How much of this does the official sulphurous acid contain?
How is the official acid prepared?
Explain the reaction which takes place in its production.
What is its specific gravity?
How may excess of sulphuric acid be detected?
What are its uses? Give the dose.
What is official phosphoric acid?
Give the formula in symbols and molecular weight of orthophosphoric acid.
How may the official acid be prepared?
Explain the rationale of the reaction which takes place.
What dangerous impurity is likely to be present? Where does it come from?
What is the specific gravity of the official acid?
What is its principal use?
How may the following impurities be detected?—viz.: Phosphorous acid; arsenic acid; nitric acid; sulphuric acid; hydrochloric acid; pyrophosphoric and metaphosphoric acids.
How is diluted phosphoric acid made?
How much orthophosphoric acid does it contain?
What is its specific gravity?
If a precipitate occurs when this acid is mixed with tincture of ferric chloride, what is indicated?
What are its uses and doses?
What is the Latin official name of diluted hypophosphorous acid?
How much absolute hypophosphorous acid does it contain?
Give the formula in symbols and the molecular weight of hypophosphorous acid.

CHAPTER XXXIV.

PREPARATIONS OF THE HALOGENS.

Chlorine, Bromine, and Iodine.

Cl; 35.37. Br; 79.76. I; 126.53.

FOUR elements, *chlorine*, *bromine*, *iodine*, and *fluorine*, are termed halogens (salt-producers). Fluorine is of so little interest in pharmacy that it will not be noticed: the other three are of great interest both to medicine and to pharmacy.

Chlorine. Cl; 35.37.

Chlorine is a greenish-yellow, gaseous body, having a very suffocating odor; its specific gravity is 2.45 (when liquefied 1.33). Its most useful and characteristic property is that of bleaching organic coloring principles: the presence of water is necessary to effect this object. Chlorine is one of the most reliable disinfectants: it is principally used in combination with lime as bleaching powder, the official name being Calx Chlorata.

Chlorine combines with hydrogen and the metals, but has very little attraction for oxygen; its principal hydrogen compound is hydrochloric acid, HCl (see Acidum Hydrochloricum). The compounds of chlorine with metals and bases are termed chlorides: they will be considered under the heads of their respective bases.

Chlorine combines indirectly with oxygen, and the compounds produced by the union of the oxyacid, chloric acid, $HClO_3$, with metals or bases are termed chlorates. Perchlorates are also known.

Tests for Chlorides and Chlorates.

Chlorides in solution, or hydrochloric acid, may be recognized by the addition of a solution of silver nitrate; a curdy white precipitate is produced, which is soluble in ammonia water, but insoluble in nitric acid.

Chlorates are recognized by the evolution of oxygen when heated, and by the reaction of the residue corresponding with that of chlorides.

Official Preparations of Chlorine, Bromine, and Iodine.

Chlorine.—Made by the action of heat upon hydrochloric acid and manganese dioxide.
Aqua Chlori.—An aqueous solution of chlorine containing 0.4 p.c. of the gas.

Chlorine loosely combined.

Calx Chlorata.—Made by subjecting calcium hydrate to the action of chlorine.
Liquor Sodæ Chloratæ.—Made by decomposing solution of chlorinated lime with sodium carbonate.

Bromum (Bromine).—Made by decomposing crude magnesium bromide with chlorine.

Iodum (Iodine).—Made by decomposing crude sodium iodide with manganese dioxide and sulphuric acid and subliming.

Tinctura Iodi.—A 7 p.c. alcoholic solution of iodine.

Liquor Iodi Compositus —A 5 p.c. aqueous solution of iodine, made soluble by the addition of 10 p.c. of potassium iodide.

Unguentum Iodi.—4 p.c. iodine; 1 p.c. potassium iodide; 2 p.c. water, with benzoinated lard.

Iodine loosely combined.

Syrupus Acidi Hydriodici.—1 p c. syrupy solution of hydriodic acid.

Unofficial Preparations of Chlorine, Bromine, and Iodine.

Acidum Hypochlorosum, $HClO$. Hypochlorous Acid.	Agitate chlorine water with precipitated mercuric oxide. Distil the liquid to remove mercuric chloride, and collect the distillate.
Acidum Chloricum, $HClO_3$. Chloric Acid.	Decompose barium chlorate with an equivalent amount of pure diluted sulphuric acid; pour off the clear solution of chloric acid, and evaporate carefully *in vacuo* over strong sulphuric acid.
Acidum Perchloricum, $HClO_4$. Perchloric Acid.	Distil pure dry potassium perchlorate with four times its weight of concentrated (previously boiled) sulphuric acid. Collect the yellow distillate.
Bromi Chloridum. Bromine Chloride.	Pass chlorine gas over bromine.
Acidum Bromicum. Bromic Acid.	Decompose barium bromate with an equivalent amount of diluted sulphuric acid, filter, and evaporate.
Acidum Hydriodicum, HI. Hydriodic Acid.	See Syrupus Acidi Hydriodici, U. S. P., p. 300.
Acidum Iodicum, HIO_3. Iodic Acid.	Heat 1 p. iodine with 10 p. nitric acid in a retort until the iodine is dissolved and fumes cease to be evolved. Evaporate the solution, and heat the residue to 200° F. until all trace of acid is removed. Collect the white powder.
Acidum Periodicum, HIO_4. Periodic Acid.	Add 1 p. iodine to a solution of 7 p. sodium carbonate in 100 p. water, and pass chlorine into the heated liquid until a precipitate ceases to form. Dissolve this precipitate in pure nitric acid, then add silver nitrate, and dissolve the resulting precipitate in hot diluted nitric acid. Then concentrate to crystallize. Treat the crystals with water, filter, and evaporate.
Amylum Iodatum. Iodized Starch.	5 p.c. iodine moistened with water and triturated with starch. It has been asserted by Bondonneau, Payen, Fritzsche, and others that iodine forms with starch a definite compound, and the formulas $(C_6H_{10}O_5)_5I$ and $(C_6H_{10}O_5)_{10}I$ have been assigned to it. The existence of these compounds is regarded as doubtful, however, and the U. S. P. 1880 terms the mixture iodized starch. Iodized starch is a convenient preparation for administering iodine internally, the principal advantage being that starch forms an admirable diluent and the iodine is freed from irritant properties. The dose is two to four drachms (7.7 to 15.5 Gm.).

Chlorine in its free state is used officially in aqua chlori, or chlorine water (see page 288).

AQUA CHLORI. *U. S.* Chlorine Water.

Chlorine water is made by heating hydrochloric acid with manganese dioxide, and conducting the generated chlorine into distilled water until a saturated solution is produced: it should contain at least 0.4 per cent. of the gas (see page 288).

$$\underset{\text{Manganese Dioxide.}}{MnO_2} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Manganese Chloride.}}{MnCl_2} + \underset{\text{Chlorine.}}{Cl_2} + \underset{\text{Water.}}{2H_2O}.$$

The chlorine water must be kept secluded from the light, to prevent its partial conversion into hydrochloric acid through the decomposition of the water by the union of the chlorine with its hydrogen.

Aqua Chlori. *U. S.*	Impurities.	Tests for Impurities.
A greenish-yellow, clear liquid, having the suffocating odor and disagreeable taste of Chlorine, and leaving no residue on evaporation. It instantly decolorizes dilute solutions of litmus, indigo, and other vegetable coloring matters.	Corresponding to at least 0.4 per cent. of Chlorine.	On mixing 17.7 Gm. of Chlorine Water with a solution of 1 Gm. of potassium iodide in 10 C.c. of water, the resulting deep-red liquid should require for complete decoloration at least 20 C.c. of decinormal sodium hyposulphite V.S.
	Hydrochloric Acid.	When Chlorine Water is shaken with an excess of mercury until the odor of Chlorine has disappeared, the remaining liquid should be at most but faintly acid.

The little apparatus shown in Fig. 225 is well adapted for making small quantities of chlorine water rapidly. Chlorine water is sometimes made extemporaneously by placing three fluidrachms of hydrochloric acid in a pint bottle, adding forty grains of potassium chlorate, and when the bottle is nearly filled with chlorine vapor, adding one fluidounce of distilled water. The bottle should now be stoppered, and, when the crystals have dissolved, sufficient distilled water is added to make one pint. This method is not to be compared in efficiency with the official process. The liquid contains free hydrochloric acid and potassium chloride; the explosive gas Cl_2O_4 is generated also, but not in sufficient quantity to be dangerous if the above directions are carefully carried out.

Uses.—Chlorine water is antiseptic and stimulant: it is used as a gargle in scarlet fever, diphtheria, and similar diseases. Chlorine in the gaseous state is largely used as a disinfectant. A convenient way of generating it is by the well-known *chlorine saucer disinfectant:* this is made by pouring half a fluidounce of equal measures of sulphuric acid and water upon two hundred grains of a finely-ground mixture of equal parts of black manganese oxide and common salt, contained in a saucer. Chlorine is gradually evolved from this mixture for several days. Chlorinated lime and solution of chlorinated soda both owe their properties to the presence of chlorine. They will therefore be considered here.

CALX CHLORATA. *U. S.* Chlorinated Lime.

"A compound resulting from the action of Chlorine upon Calcium Hydrate, and containing not less than 35 per cent. of available Chlorine."

Preparation.—Chlorinated lime—or chloride of lime, as it is more frequently and less properly called—is made by exposing finely-powdered calcium hydrate, which is placed on trays in a suitable chamber, to the action of chlorine. The gas is absorbed by the lime, and a

chemical compound is formed, which is represented by the formula $CaOCl_2$. Various views have been held by chemists as to its exact composition, but the weight of opinion is now in favor of considering it to be as above stated, and yielding, by decomposition with water, calcium hypochlorite and calcium chloride. The value of chlorinated lime, whether used for bleaching purposes or in medicine, depends upon the amount of chlorine which can be eliminated; for, whatever view is accepted as to its composition, it is admitted that the chlorine is very loosely combined.

Calx Chlorata. *U. S.*	Tests.
A white, or grayish-white, granular powder, or friable lumps, becoming moist and gradually decomposing on exposure to air, having a hypochlorous acid odor and a disagreeable, saline taste. It is partially soluble in water and in alcohol. On dissolving Chlorinated Lime in diluted acetic acid, chlorine gas is given off, and a trifling residue left undissolved.	Its solution in diluted acetic acid yields, with ammonium oxalate, a white precipitate insoluble in acetic acid but soluble in hydrochloric acid. The aqueous solution first colors red litmus paper blue, and then bleaches it. If 0.35 (0.354) Gm. of Chlorinated Lime be thoroughly triturated with 50 C.c. of water and carefully transferred, together with the washings, into a flask, and then 0.8 Gm. of potassium iodide and 5 C.c. of diluted hydrochloric acid added, the reddish-brown liquid, mixed, towards the end of the titration, with a few drops of starch T.S., should require, for complete decoloration, not less than 35 C.c. of decinormal sodium hyposulphite V.S. (each C.c. corresponding to 1 per cent. of available chlorine).

Chlorinated Lime should be preserved in well-closed vessels in a cool or dry place. A very excellent method of preservation is now in vogue, in which the dry chlorinated lime is hermetically sealed in straw-board boxes, which are protected on the inside by a composition coating containing rosin. When exposed to the air it soon becomes moist, on account of the hygroscopic character of the calcium chloride present.

Uses.—Chlorinated lime is used in the preparation of solution of chlorinated soda, but most largely as a disinfectant, through its power of arresting animal and vegetable putrefaction. It is rarely given internally, but is sometimes used as a stimulant and alterative, in doses of three to six grains. Externally, it is used in solution as an application to ulcers, burns, etc.

LIQUOR SODÆ CHLORATÆ. *U. S.* Solution of Chlorinated Soda.

[Labarraque's Solution.]

An aqueous solution of several chlorine-compounds of sodium, containing at least 2 6 per cent., by weight, of available chlorine.

	Metric.	Old form.
Sodium Carbonate	150 Gm.	21 oz. av.
Chlorinated Lime	75 Gm.	10½ oz. av.
Water, a sufficient quantity,		
To make	1000 Gm.	8 pints.

Triturate the Chlorinated Lime with 200 C.c. [old form 25½ fl. oz.] of Water, gradually added, until a uniform mixture results. Allow

the heavier particles to subside, and transfer the thinner, supernatant portion to a filter. Then triturate the residue again with 200 C.c. [old form 25½ fl. oz.] of Water, transfer the whole to the filter, and, when the liquid has drained off, wash the filter and contents with 100 C.c. [old form 13 fl. oz.] of Water. Dissolve the Sodium Carbonate in 300 C.c. [old form 38 fl. oz.] of hot Water, and add this solution to the previously obtained filtrate contained in a suitable vessel. Stir or shake the mixture thoroughly, and, if it should become gelatinous, warm the vessel until the contents liquefy. Then transfer the mixture to a new filter, and, when no more liquid drains from it, wash the filter and contents with enough Water to make the product weigh 1000 Gm. [or measure, old form, 8 pints].

Keep the Solution in well-stoppered bottles, protected from light.

Double decomposition results in the formation of insoluble calcium carbonate or precipitated chalk, whilst sodium hypochlorite and sodium chloride remain in solution.

$$\underset{\text{Chlorinated Lime.}}{Ca(OCl)_2} + \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Sodium Carbonate.}}{2Na_2CO_3} = \underset{\text{Sodium Hypochlorite.}}{2NaOCl} + \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3}.$$

Liquor Sodæ Chloratæ. *U.S.*	Tests.
A clear, pale greenish liquid, of a faint odor of chlorine, a disagreeable and alkaline taste, and an alkaline reaction. Sp. gr. about 1.052 at 15° C. (59° F.). Addition of hydrochloric acid causes an effervescence of chlorine and carbonic acid gas. The solution at first colors red litmus paper blue and then bleaches it.	If 6.7 (6.74) Gm. of the Solution be mixed with 50 C.c. of water, then 2 Gm. of potassium iodide and 10 C.c. of hydrochloric acid added, together with a few drops of starch T.S., it should require not less than 50 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish tint of the liquid (each C.c. of the volumetric solution corresponding to 0.052 per cent. of available chlorine).

Uses.—Solution of chlorinated soda is principally employed as a disinfectant or bleaching solution: it is frequently termed *Labarraque's Solution*, and is sometimes substituted for *Eau de Javelle* (*Javelle's water*), a French preparation made with potassium carbonate instead of sodium carbonate.

BROMUM. *U.S.* Bromine.

Br; 79.76.

Preparation.—This non-metallic element, which is in the form of a dark red, volatile liquid, is produced largely in the United States, in Ohio, West Virginia, and Pennsylvania. It is prepared from the brine obtained from salt-wells by the following process. The brine is concentrated to separate chlorides, sulphates, etc., by crystallization. The mother-liquor, containing the bromine principally in the form of magnesium bromide, is decomposed by treating it with chlorine gas produced from manganese dioxide and hydrochloric acid.

The manner of conducting this process is peculiar. The original

salt-liquor, or brine, is pumped out of the ground and evaporated to about 15° B. in large iron pans, then allowed to settle, and is further evaporated in wooden tanks heated by steam pipes to the point of crystallization. These tanks, five in number, are placed at different elevations, one above the other. Each day the liquor is run off from No. 1, the highest, to No. 2, next day to No. 3, and so on until it reaches No. 5, the crystallized salt being removed from each tank after draining off the liquor. The brine which reaches No. 5 is bittern, and consists chiefly of calcium, magnesium, sodium, and aluminum chlorides, with varying percentages of sodium and calcium bromides.

The bittern marking 30° to 38° B. is evaporated to about 45° B. The liquor is then run into stone stills, materials for generation of chlorine added, and heat applied by means of steam until the bromine has all been vaporized. It is condensed and collected in cooled receivers.

$$\underset{\text{Magnesium Bromide.}}{MgBr_2} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Magnesium Chloride.}}{MgCl_2} + \underset{\text{Bromine.}}{2Br.}$$

On account of its very caustic and irritating properties, *great care* must be used in handling bromine. Its vapor is very corrosive and suffocating.

Chemically, there is a close analogy between bromine and chlorine. Its combination with hydrogen is hydrobromic acid, which is official (see page 448).

The salts, termed bromides, are used very largely in medicine. They will be considered under the heads of their respective bases. *Bromates*, formed, like chlorates, by combination with the corresponding oxyacid, bromic acid, $HBrO_3$, are rarely used.

Tests.

1. If a solution of a bromide be treated with a solution of silver nitrate, a yellowish-white precipitate of silver bromide is produced, which is insoluble in nitric acid and but slightly soluble in ammonia water.
2. If chlorine water be added to a strong solution of a bromide, bromine is liberated. This may be dissolved by agitation with carbon disulphide or ether.
3. If concentrated sulphuric acid be added to a bromide (not in solution), reddish vapors of bromine are evolved.

Bromum. *U. S.*	Odor.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, dark brownish-red, mobile liquid, evolving, even at the ordinary temperature, a yellowish-red vapor, highly irritating to the eyes and lungs. Sp. gr. 2.990 at 15° C. (59° F.).	A peculiar suffocating odor, resembling that of chlorine.	30 parts at 15° C. (59° F.).	Very soluble, with gradual decomposition of the alcohol.	Very soluble in ether, with gradual decomposition of the ether; very soluble in chloroform and in carbon disulphide with a deep reddish - yellow color.

Tests for Identity.	Impurities.	Tests for Impurities.
It is completely volatilized by exposure to air or to heat. It destroys the color of solutions of litmus and indigo, and renders gelatinized starch yellow.	Bromoform or other organic Bromine compounds.	If Bromine be added to an excess of potassium or sodium hydrate T.S., it should combine to form a permanently clear liquid, without the separation of oily drops, or the development of an odor resembling that of chloroform.
	More than 3 per cent. of Chlorine.	If 1 C.c. of a saturated aqueous solution of Bromine be diluted with 9 C.c. of water, then mixed with 3 C.c. of ammonium carbonate T.S., and 5 C.c. of decinormal silver nitrate V.S., and the whole actively shaken, the filtered liquid, when supersaturated with nitric acid, should not become more than opalescent, nor separate a flocculent precipitate within three minutes.
	Iodine.	If an aqueous solution of Bromine be poured upon reduced iron and shaken with the latter until it has become nearly colorless, the filtered liquid, on the addition of a small amount of ferric chloride and of starch T.S., should not assume a blue color.

Uses.—Bromine is rarely used in its undiluted condition. When diluted with water in the proportion of forty minims in a pint, it forms a powerful wash. It is the important ingredient in *Bibron's antidote* to rattlesnake poison, which is made by dissolving three hundred grains of bromine in half a pint of diluted alcohol, and then placing four grains of potassium iodide and two grains of corrosive mercuric chloride in a mortar: sufficient of the solution is added to dissolve the salts, this being mixed with the rest of the solution. The utmost care should be exercised in handling bromine: the vapor not only attacks the eyes and nostrils, but renders the air irrespirable. It acts on metallic surfaces, and may ruin balances if permitted to remain in contact with them.

IODUM. *U.S.* Iodine.

I; 126.53.

Preparation.—Iodine is a non-metallic element widely distributed in nature. It was formerly exclusively obtained from *kelp*, the ashes of certain sea-weeds. In addition to this source, it is now made from the mother-liquors obtained from the crystallization of sodium nitrate in South America. These contain the iodine in the form of sodium iodide and sodium iodate. The iodides are decomposed by chlorine, iodine being set free, whilst the iodine from the iodates is precipitated by treatment with acid sodium sulphite. The liquid obtained by lixiviating kelp contains the iodine as sodium iodide. A concentrated solution of the impure iodide is treated with sulphuric acid, then distilled with manganese dioxide; the separated iodine condenses in a series of glass receivers.

$$\underset{\text{Sodium Iodide.}}{2NaI} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Manganese Dioxide.}}{MnO_2} = \underset{\text{Iodine.}}{I_2} + \underset{\text{Manganese Sulphate.}}{MnSO_4} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Water.}}{2H_2O}$$

Iodine of excellent quality is now readily obtained: the presence of a smal. quantity of water, however, is often noticed.

Iodum. U.S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Heavy, bluish-black, dry and friable, rhombic plates of a metallic lustre. Iodine imparts a deep brown, slowly evanescing stain to the skin, and slowly destroys vegetable colors. Specific gravity: 4.948 at 17° C. (62.6° F.).	Distinctive odor; sharp and acrid taste; neutral reaction.	5000 parts.	At 15° C. (59° F.), 10 parts with a brown color.	Very soluble in ether, carbon disulphide, and chloroform, with a violet color, and in a solution of potassium iodide with a brown color.

Tests for Identity, and Quantitative Tests.	Impurities.	Tests for Impurities.
It is slowly volatilized at ordinary temperatures. When heated to 114° C. (237.2° F.) it melts, and then rises in purple vapor, being gradually dissipated without leaving a residue. With starch T.S. it produces a dark blue color. If 0.32 Gm. of Iodine, with 1 Gm. of potassium iodide, be dissolved in 20 C.c. of water, and the solution mixed with a few drops of starch T.S., it should require not less than 25 C.c. of decinormal sodium hyposulphite V.S. to fully decolorize the liquid (corresponding to 98.85 per cent. of pure Iodine).	Moisture.	A solution of Iodine in chloroform should be perfectly clear and limpid.
	Iodine Cyanide.	Triturate 0.5 Gm. of finely-powdered Iodine with 20 C.c. of water, and filter off the solution. To one-half of this solution, in a test-tube, carefully add decinormal sodium hyposulphite V.S., until the solution is just decolorized. Then add a few drops of ferrous sulphate T.S., and subsequently a little sodium hydrate T.S., and heat the mixture gently. On now adding a slight excess of hydrochloric acid, the liquid should not assume a blue color.
	Limit of Chlorine or Bromine.	To the other half of the aqueous filtrate, in a test-tube, add a slight excess of silver nitrate T.S., shake actively, allow the precipitate to subside, and, having poured off the clear, supernatant liquid completely, shake the precipitate with a mixture of 1 C.c. of ammonia water and 9 C.c. of water, and filter. Upon the addition of a slight excess of nitric acid to the filtrate, not more than a slight opalescence should make its appearance.

Iodine is closely related chemically to bromine and chlorine. Its combination with hydrogen (hydriodic acid) is official as Syrupus Acidi Hydriodici, syrup being necessary to preserve it from decomposition. The iodides are largely used in medicine. The iodates, like the chlorates and bromates, are produced by combination with the oxyacids of iodine, iodic and periodic acids. They are of little interest pharmaceutically.

Tests for Iodine and Iodides.

1. A dark blue color (fading upon the application of heat) is produced when iodine is brought in contact with starch mucilage.

2. An iodide is detected by first liberating the iodine by adding a little chlorine water and then using starch mucilage; or if carbon disulphide be added the iodine dissolves in it.

3. Silver nitrate produces with a solution of an iodide a yellowish-white precipitate of silver iodide, which is insoluble in nitric acid and but slightly soluble in ammonia water.

4. A yellow precipitate of lead iodide is produced by adding a solution of lead salt to a neutral solution of an iodide.

5. A red precipitate of mercuric iodide is produced by adding a solution of mercuric chloride to a neutral solution of an iodide.

Uses.—Iodine is very largely used in medicine. It excites the action of the absorbent and glandular systems, and is employed both internally and externally.

TINCTURA IODI. *U. S.* Tincture of Iodine.

A 7 per cent. alcoholic solution of Iodine (see page 369), 6.3 C.c. of the Tincture, mixed with a solution of 2 Gm. of potassium iodide in 25 C.c. of water and a little starch T.S., should require, for complete decoloration, 35 C.c. of the volumetric solution of decinormal sodium hyposulphite (corresponding to about 7 Gm. of iodine in 100 C.c.).

LIQUOR IODI COMPOSITUS. *U. S.* Compound Solution of Iodine.

[LUGOL'S SOLUTION.]

	Metric.	Old form.
Iodine	5 Gm.	½ oz. av.
Potassium Iodide	10 Gm.	1 oz. av.
Distilled Water, a sufficient quantity,		
To make	100 Gm.	8¾ fl. oz.

Dissolve the Iodine and Potassium Iodide in a sufficient quantity of Distilled Water to make the product weigh 100 Gm. [or measure, old form, 9 fl. oz.].

Keep the Solution in glass-stoppered bottles.

In this Solution iodine is dissolved in water with the assistance of potassium iodide. Iodine dissolves sparingly in water, but freely in a solution of potassium iodide. In using that salt to render iodine more soluble in water, the iodide is generally employed in a quantity twice the weight of the iodine. The Solution contains about 3.25 grains of iodine in the fluidrachm.

The official quantitative test requires that 12.66 Gm. of the Solution, mixed with a little gelatinized starch, should require, for complete decoloration, 50 C.c. of the volumetric solution of sodium hyposulphite.

Uses.—This Solution affords an efficient means of administering iodine internally. It is given in five-minim (0.3 C.c.) doses, and, to prevent gastric irritation, it must be largely diluted.

UNGUENTUM IODI. *U. S.* Iodine Ointment.

An ointment containing 4 per cent. of Iodine, 1 per cent. of Potassium Iodide, 2 per cent. of Water, and 93 per cent. of Benzoinated Lard. (See Unguenta, Part VI.)

SYRUPUS ACIDI HYDRIODICI. *U. S.* Syrup of Hydriodic Acid.

This is a syrupy liquid containing 1 per cent. of absolute hydriodic acid [HI; 127.53] and having the specific gravity 1.313 (see page 300). It is made by dissolving potassium iodide and potassium hypophosphite in water and decomposing them by adding a solution of tartaric acid in diluted alcohol. Tartaric acid forms with soluble potassium salts acid potassium tartrate (cream of tartar); this is but sparingly soluble

in water, and less so in diluted alcohol, and hence is precipitated out. Hydriodic acid is liberated, and dissolves in the aqueous liquid. A little hypophosphorous acid is also liberated by the action of the tartaric acid on the potassium hypophosphite. The reason for placing the mixture in ice-water is to facilitate the crystallization of the acid potassium tartrate by lowering the temperature. The alcohol is used with the same intention. The object of this preparation is to furnish an agreeable mode of administering hydriodic acid, and also a liquid which will be reasonably stable. *Hydriodic acid*, HI, is easily decomposed in simple aqueous solution, free iodine being liberated, and if taken internally when in this condition, serious results might follow. Syrup of hydriodic acid was formerly made by passing hydrogen sulphide through an alcoholic solution of iodine (see U. S. P. 1880). The chemical reaction which takes place may be expressed as follows:

$$\underset{\text{Iodine.}}{4I} + \underset{\text{Hydrogen Sulphide.}}{2H_2S} = \underset{\text{Hydriodic Acid.}}{4HI} + \underset{\text{Sulphur.}}{2S}.$$

Uses.—Syrup of hydriodic acid is used as an alterative and antipyretic. The dose is twenty to forty minims (1.2 to 2.4 C.c.).

QUESTIONS ON CHAPTER XXXIV.

PREPARATIONS OF THE HALOGENS.

What is meant by the term "halogen"?
What four elements are called "halogens"?
Describe chlorine. Give its symbol and molecular weight.
What is its specific gravity?
What is its most characteristic property?
What is its principal use, and how is it generally employed?
What is its principal hydrogen compound?
What are its compounds with metals and bases termed?
When combined with oxygen, what are its compounds with metals and bases termed?
How may chlorides in solution or hydrochloric acid be recognized?
How may chlorates be recognized?
How is chlorine water recognized?
What amount of the gas should it contain?
Explain the reaction which takes place in its production.
How may its strength be tested?
How may excess of hydrochloric acid be detected?
How may chlorine water be prepared extemporaneously?
What explosive gas is generated at the same time?
What does the liquid contain besides chlorine?
What are the uses of chlorine water?
How may chlorine be conveniently used as a disinfectant?
What is chlorinated lime? Give its Latin name.
How much available chlorine should it contain?
How is it prepared?
What is a popular name for it?
Wherein does it differ from the French preparation known as "Eau de Javelle" (Javelle's Water)?
Give the symbol and atomic weight of bromine.

Where is it obtained, and how is it prepared?
Describe the process.
What is bittern, and what does it contain?
What is the character of the vapor of bromine?
What is its combination with hydrogen called?
What are its salts called?
What are the tests for bromine?
What is its specific gravity?
How may the presence of iodine be detected?
What is its medicinal use?
What is "Bibron's antidote" to rattlesnake poison?
Give the symbol and atomic weight of iodine.
How was it formerly obtained, and how is it now obtained?
Explain the reaction which takes place in its production.
How soluble is iodine in alcohol?
How may the following impurities be detected?—viz.: moisture; iodine chloride; iodine cyanide; more than traces of chlorine or bromine.
In what form is its combination with hydrogen official?
What are the tests for iodine and the iodides?
What is its use in medicine?
What is tincture of iodine?
How may its strength be tested?
How is it used medicinally, and what is the dose?
Give the formula for compound solution of iodine.
What is the official name and synonyme of compound solution of iodine?
How much iodine does a fluidounce of the solution contain?
What is the object of using iodide of potassium in this preparation?
How much iodine is there in a fluidounce?
How is it used medicinally, and what is the dose?
What is ointment of iodine?
How is syrup of hydriodic acid prepared?
How much absolute hydriodic acid does it contain?
What is its specific gravity?
What are the objects of this preparation?
What is the chemical reaction which takes place when hydrosulphuric acid is passed into a solution containing iodine?
What is the use of syrup of hydriodic acid, and what is the dose?

CHAPTER XXXV.

SULPHUR AND PHOSPHORUS.

S; 31.98. P; 30.96.

THESE two elements furnish many important compounds to medicine. They present several analogies, both physically and chemically.

Official Preparations of Sulphur and Phosphorus.

Sulphur Sublimatum.—Made by subliming crude sulphur.
Sulphur Lotum.—Made by washing sublimed sulphur.
Sulphur Præcipitatum.—Made by precipitating a solution of calcium disulphide with HCl.
Sulphuris Iodidum —Made by heating iodine with sulphur.
Unguentum Sulphuris.—Made by mixing 30 parts of sublimed sulphur with 70 parts of benzoinated lard.

Sulphur loosely combined.

Hydrogen Sulphide.—By acting on ferrous sulphide with diluted sulphuric acid. (See Tests.)
Carbonei Disulphidum.—By passing sulphur vapor over red-hot charcoal.

Phosphorus.—Made by deoxidizing phosphoric acid with carbon.
Oleum Phosphoratum.—Made by dissolving 1 per cent. of phosphorus in almond oil.
Pilulæ Phosphori.—Each pill contains $\frac{1}{100}$ of a grain of phosphorus.

Unofficial Compounds of Sulphur and Phosphorus.

Acidum Hyposulphurosum, H_2SO_2. Hyposulphurous Acid.	Add metallic zinc to sulphurous acid contained in a closed vessel.
Acidum Hypophosphorosum, H_3PO_2. Hypophosphorous Acid.	Decompose barium hypophosphite by the aid of sulphuric acid, filter, and evaporate to a syrupy consistence. (See Acidum Hypophosphorosum Dilutum, page 488.)
Acidum Metaphosphoricum, HPO_3. Metaphosphoric Acid.	Evaporate a solution of phosphoric acid until the residue ceases to give off water. This solidifies on cooling, and on exposure absorbs moisture and deliquesces.
Acidum Phosphorosum, H_3PO_3. Phosphorous Acid.	Expose phosphorus to moist air under a bell-jar, and collect the heavy white vapor which falls, in a vessel containing water.
Acidum Pyrophosphorosum, $H_4P_2O_7$. Pyrophosphorous Acid.	Precipitate sodium pyrophosphate with a solution of lead acetate, and decompose the well-washed lead pyrophosphate with hydrogen sulphide.

Sulphur. S; 31.98.

Sulphur is found uncombined in Sicily and in other parts of the world. In the form of sulphates and sulphides it is widely diffused. It is prepared for use by fusing it, allowing it to stand to permit the earthy impurities to settle, and then pouring it into cylindrical moulds. The sulphur in cylinders is termed *roll-sulphur*.

Three forms of sulphur are official,—sublimed, washed, and precipitated sulphur.

Sulphur forms with hydrogen an offensive gas, which is known officially as hydrogen sulphide, H_2S. It is also termed *sulphuretted hydrogen* and *hydrosulphuric acid*. The formula for its preparation will

be found under "Tests," in Part V. It is used for proving the presence or absence of certain metallic salts, lead, bismuth, antimony, copper, mercury, zinc, etc., with which it produces characteristic precipitates. *Sulphides* are compounds of elements with sulphur. Some of the sulphides are analogous to acids, others to bases; and these different sulphides, by combining with one another, form compounds, which, from their analogy to salts, are called by Berzelius *sulpho-salts*. It forms with oxygen two oxides, *sulphurous* oxide, SO_2, and *sulphuric* oxide, SO_3. These oxides, by their union with water, form *sulphurous acid*, H_2SO_3, and *sulphuric acid*, H_2SO_4. These are considered in the chapter on inorganic acids. There is also known *hyposulphurous acid*, H_2SO_2, the corresponding oxide of which is not known, and *thiosulphuric acid* (frequently known as hyposulphurous acid), $H_2S_2O_3$, and a series of acids, $H_2S_2O_6$, $H_2S_3O_6$, $H_2S_4O_6$, and $H_2S_5O_6$, known as the *thionic series*. Sulphurous acid forms with bases salts which are termed *sulphites*. The salts similarly produced from sulphuric acid are termed *sulphates*. The sulphates are much more important salts. Pharmaceutically, they have totally different properties. The official sulphites and sulphates will be considered under their respective bases.

Tests for Sulphites and Sulphurous Acid.

1. Solution of barium chloride produces with sulphurous acid or a solution of a sulphite, a white precipitate of barium sulphite, which is soluble in hydrochloric acid.
2. If a solution of a sulphite or sulphurous acid be added to diluted sulphuric acid and zinc, hydrogen sulphide gas is liberated.
3. An acid solution of potassium permanganate is decolorized and deoxidized by sulphurous acid.

Tests for Sulphates and Sulphuric Acid.

1. A solution of barium chloride produces a white insoluble precipitate of barium sulphate with sulphuric acid or a soluble sulphate.
2. A soluble salt of lead produces a white insoluble precipitate of lead sulphate with sulphuric acid or a soluble sulphate.

SULPHUR SUBLIMATUM. *U.S.* Sublimed Sulphur.

S; 31.98.

Preparation.—When vapors of sulphur are conducted into a chamber properly cooled, they are condensed in the form of a crystalline powder, which collects on the sides and bottom of the chamber. The yellowish powder is known as sublimed sulphur, or *flowers of sulphur*. It is in the form of a fine, yellow powder, having a slight, characteristic odor, and a faintly acid taste. Insoluble in water; slightly soluble in absolute alcohol; more readily soluble in benzin, benzol, oil of turpentine, and many other oils; also in ether, in chloroform, and in boiling, aqueous solutions of alkaline hydrates. Carbon disulphide promptly dissolves a portion of it, but leaves a residue of crystalline sulphur, which may be dissolved by a boiling solution of an alkaline hydrate.

At 115° C. (239° F.) it melts, and at a higher temperature it volatilizes, or, if air be admitted, burns to sulphur dioxide, characterized by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the gas. When agitated with water, the latter gives an acid reaction with litmus paper. The amount of residue left after volatilizing or burning a weighed portion of it should not exceed 0.5 per cent.

Uses.—Sublimed sulphur is given internally as a laxative and diaphoretic, in doses of from one to three drachms (3.8 to 11.6 Gm.). It is often combined with potassium bitartrate and administered to children mixed with honey or molasses. In diphtheritic croup it is sometimes used to remove the exudation by insufflation; externally, it is used as an ointment in scabies and other skin diseases.

SULPHUR LOTUM. *U.S.* Washed Sulphur.

S = 31.98.

	Metric.	Old form.
Sublimed Sulphur	100 Gm.	16 oz. av.
Ammonia Water	10 C.c.	1½ fl. oz.
Water, a sufficient quantity.		

Pass the Sublimed Sulphur through a No. 30 sieve, mix it thoroughly with 100 C.c. [old form 1 pint] of Water, add 10 C.c. [old form 1½ fl. oz.] of Ammonia Water, and digest for three days, agitating occasionally. Then add 100 C.c. [old form 1 pint] of Water, transfer the mixture to a muslin strainer, and wash the Sulphur with Water until the washings cease to impart a blue color to red litmus paper. Then allow it to drain, press the residue strongly, dry it rapidly at a moderate heat, and pass it through a No. 30 sieve.

Sublimed sulphur is frequently contaminated with small quantities of sulphuric acid and other impurities, and the object of the ammonia in the above process is to neutralize the acid, the ammonium sulphate being subsequently washed out.

Sulphur Lotum. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Absolute Alcohol.	Other Solvents.
A fine yellow powder. When heated to 115° C. (239° F.), Washed Sulphur melts, and at a higher temperature it is volatilized, or, if air be admitted, burns to sulphur dioxide, which is identified by its characteristic odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the gas. The amount of residue left after volatilizing or igniting a weighed portion of it should not exceed 0.5 per cent.	Odorless and tasteless.	Insoluble.	Slightly soluble.	More readily soluble in benzin, benzol, oil of turpentine, and many other oils; also in ether, in chloroform, and in boiling, aqueous solutions of alkaline hydrates. Carbon disulphide promptly dissolves a portion of it, but leaves a residue of insoluble sulphur, which may be dissolved by a boiling solution of an alkaline hydrate.

Impurities.	Tests for Impurities.
Earthy or Metallic Impurities.	If 0.5 Gm. of Washed Sulphur be boiled with 10 C.c. of sodium hydrate T.S., it should be completely dissolved, leaving no residue.
Arsenic.	If 0.5 Gm. of Washed Sulphur be digested for several hours with 10 C.c. of ammonia water, the clear filtrate should not be colored yellow, nor be rendered turbid, by acidulation with hydrochloric acid, even after the addition of an equal volume of hydrogen sulphide T.S.
Acid and Ammonia.	If 5 C.c. of water be agitated with 2 Gm. of Washed Sulphur, the liquid should not change the color of red or blue litmus paper.
Selenium.	If 0.5 Gm. of Washed Sulphur be boiled with a solution of 0.5 Gm. of potassium cyanide in 5 C.c. of water, and, after filtration, the clear liquid be acidulated with hydrochloric acid, it should not assume a reddish color, even after standing for an hour.

Uses.—Washed sulphur is preferred to sublimed sulphur for internal administration; the small quantity of sulphuric acid present in the latter sometimes produces griping. The dose is from one to three drachms. It is used in the preparation of Compound Liquorice Powder, Iodide of Sulphur, and Sulphur Ointment. (See Pulveres and Unguenta.)

SULPHUR PRÆCIPITATUM. *U.S.* Precipitated Sulphur.

$$S = 31.98.$$

	Metric.	Old form.
Sublimed Sulphur	100 Gm.	16 oz. av.
Lime	50 Gm.	8 oz av.
Hydrochloric Acid,		
Water, each, a sufficient quantity.		

Slake the Lime, and mix it uniformly with 500 C.c. [old form 5 pints] of Water. Add the Sublimed Sulphur, previously sifted, and, after thorough mixing, add 1000 C.c. [old form 10 pints] of Water, and boil the mixture during one hour, stirring constantly, and replacing the Water lost by evaporation. Then cover the vessel, and permit the contents to cool and to become clear by subsidence. Carefully draw off the clear solution, and filter the remainder. To the united liquids add gradually, and with constant stirring, Hydrochloric Acid, previously diluted with an equal volume of Water, until the liquid is nearly neutralized, still retaining, however, an alkaline reaction and a yellow color. Collect the precipitate on a strainer, and wash it, until the washings are tasteless and cease to give an acid reaction with litmus paper. Then dry the product rapidly, at a moderate heat, and keep it in well-stoppered bottles.

In the above process the lime and sulphur react so as to form calcium disulphide and calcium thiosulphate (hyposulphite):

$$\underset{\text{Calcium Oxide.}}{3CaO} + \underset{\text{Sulphur.}}{6S} = \underset{\text{Calcium Disulphide.}}{2CaS_2} + \underset{\text{Calcium Thiosulphate.}}{CaS_2O_3}.$$

On the addition of hydrochloric acid, the sulphur is precipitated:

$$\underset{\text{Calcium Disulphide.}}{2CaS_2} + \underset{\text{Calcium Thiosulphate.}}{CaS_2O_3} + \underset{\text{Hydrochloric Acid.}}{6HCl} = \underset{\text{Calcium Chloride.}}{3CaCl_2} + \underset{\text{Sulphur.}}{6S} + \underset{\text{Water.}}{3H_2O}.$$

In some processes sulphuric acid is used instead of hydrochloric acid, and calcium sulphate is precipitated with the sulphur. This furnishes an inferior product, and is called *lac sulphuris*, or *milk of sulphur*.

Sulphur Praecipitatum. *U. S.*	Odor and Taste.	Solubility. Water.	Absolute Alcohol.	Other Solvents.
A fine yellow, amorphous powder. At 115° C. (239° F.) Precipitated Sulphur melts, and at a higher temperature it volatilizes, or, if air be admitted, burns to sulphur dioxide, leaving no residue.	Odorless and tasteless.	Insoluble.	Very slightly.	Readily soluble in carbon disulphide; also in benzin, benzol, oil of turpentine, and many other oils; also in ether, in chloroform, and in boiling aqueous solutions of alkaline hydrates.

Impurities.	Tests for Impurities.
Earthy or Metallic Impurities.	If 0.5 Gm. of Precipitated Sulphur be boiled with 10 C.c. of sodium hydrate T.S., it should be completely dissolved, leaving no residue.
Arsenic.	If 1 Gm. of Precipitated Sulphur be digested for several hours with 10 C.c. of ammonia water, a portion of the clear filtrate should not leave any residue on evaporation; nor should another portion be colored yellow, or rendered turbid, by acidulation with hydrochloric acid, even after the addition of an equal volume of hydrogen sulphide T.S.
Acid or Alkali.	If 5 C.c. of water be agitated with 2 Gm. of Precipitated Sulphur, the liquid should not change the color of blue or red litmus paper.
Soluble Impurities.	Nor should it leave any residue on evaporation.
Selenium.	If 0.5 Gm. of Precipitated Sulphur be boiled with a solution of 0.5 Gm. of potassium cyanide in 5 C.c. of water, and, after filtration, the clear liquid be acidulated with hydrochloric acid, it should not assume a reddish color, even after standing for an hour.

Uses.—Precipitated sulphur is much to be preferred to the other forms in liquid mixtures, as the particles are lighter and more easily suspended; the ointments made with it are smoother than those made with sublimed sulphur. The dose is from one to three drachms [3.8 to 11.6 Gm.].

SULPHURIS IODIDUM. *U. S.* Sulphur Iodide.

	Metric.	Old form.
Washed Sulphur	20 Gm.	60 grains.
Iodine	80 Gm.	240 grains.

Mix the Washed Sulphur and Iodine thoroughly by trituration; introduce the mixture into a flask, close the orifice loosely, and, by means of a water-bath, gradually and with occasional agitation apply a heat not exceeding 60° C. (140° F.), until the ingredients combine, and become of a uniformly dark color throughout. Then increase the heat to the boiling point of the water, so as to fuse the mass. Should any Iodine have sublimed and condensed on the glass, incline the flask so as to combine the Iodine with the fused mass, and then pour the latter out upon a porcelain plate or other suitable cold surface. After cooling, break the product into pieces of suitable size, and keep them in a glass-stoppered bottle, in a cool place.

This compound is one of the instances of the direct chemical union of two elements, heat being the only agent used to effect the combination: it is sometimes called *subiodide of sulphur*, or *iodine disulphide*, S_2I_2. There are some doubts, however, as to its being a definite chemical compound.

Sulphuris Iodidum. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Brittle masses of a crystalline fracture and a grayish-black, metallic lustre.	Odor of iodine; somewhat acrid taste; faintly acid reaction.	Almost insoluble.	Alcohol dissolves out the iodine and leaves the sulphur.	Very soluble in carbon disulphide; also in 60 parts of glycerin. Ether and alcohol dissolve out the iodine and leave the sulphur. Continued boiling with water vaporizes all the iodine, leaving about 20 per cent. of sulphur as residue.

Test for Identity.
On exposing Sulphur Iodide to the air, it gradually loses iodine. On heating it, some iodine sublimes at first; at a somewhat higher temperature a sublimate is formed, containing both iodine and sulphur. At a still higher temperature, the whole is volatilized, leaving only a trace of residue.

Uses.—Sulphur iodide is principally used externally in skin diseases in the form of an ointment.

CARBONEI DISULPHIDUM. *U.S.* Carbon Disulphide.

CS_2; 75.93.

[Carbonei Bisulphidum, Pharm. 1880.]

Carbon Disulphide should be kept in well-stoppered bottles, or in tin cans, in a cool place, remote from lights or fire.

This sulphide is prepared by the direct combination of carbon and sulphur at a moderate red heat. To effect this, charcoal is heated to redness in a vertical cylinder, while sulphur is admitted through a lateral tubulure near the bottom. As the sulphur melts and vaporizes, it combines with the carbon, and the carbon disulphide formed distils over through a series of condensing tubes, which, while they serve to collect the crude carbon disulphide, allow of the escape of the hydrogen sulphide formed at the same time.

It is purified by agitation with mercury and distillation in contact with white wax. It can by repeated rectification be entirely freed from its usual disgusting odor.

Carbonei Disulphidum. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A clear, colorless, very diffusive, highly refractive liquid. Sp. gr. 1.268 to 1.269 at 15° C. (59° F.).	Strong characteristic but not fetid odor; sharp, aromatic taste; neutral reaction.	Soluble in 535 parts of water at 15° C. (59° F.).	Very soluble.	Soluble in ether, chloroform, and fixed or volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
It vaporizes rapidly at ordinary temperatures, is highly inflammable, boils at 46°–47° C. (114.8°–116.6° F.), and, when ignited, burns with a blue flame, producing carbon and sulphur dioxide.	Sulphur Dioxide.	Carbon Disulphide should not affect the color of blue litmus paper moistened with water.
	Dissolved Sulphur.	A portion of the liquid evaporated spontaneously in a glass vessel should leave no residue.
	Hydrogen Sulphide.	Lead acetate T.S. agitated with the liquid should not be blackened.

Uses.—Carbon disulphide is used principally as a solvent. It is the best solvent for rubber and similar bodies. It is poisonous when taken internally, and the continuous inhalation of its vapor is very injurious.

PHOSPHORUS. *U. S.* Phosphorus.

P; 30.96.

Preparation.—Phosphorus is a non-metallic element prepared by heating acid calcium phosphate with charcoal. The acid calcium phosphate is obtained by treating calcium phosphate with sulphuric acid, calcium sulphate also being formed; the latter is afterwards separated.

$$\underset{\text{Calcium Phosphate.}}{Ca_3(PO_4)_2} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Acid Calcium Phosphate.}}{CaH_4(PO_4)_2} + \underset{\text{Calcium Sulphate.}}{2CaSO_4}.$$

Phosphorus should be carefully kept under water, in strong, well-closed vessels, in a secure and moderately cool place, protected from light.

Of the allotropic forms of phosphorus, *red phosphorus*, or *amorphous phosphorus*, is the most important. It is obtained by allowing phosphorus to remain for several days in an atmosphere of carbon dioxide at a temperature varying from 215° C. (419° F.) to 250° C. (482° F.)

Red phosphorus is not luminous and not poisonous until it is heated to 280° C. (536° F.), when it is converted into ordinary phosphorus.

Phosphorus forms with oxygen three oxides,—*phosphoric*, P_2O_5, *phosphorous*, P_2O_3, and *hypophosphorous*, P_2O, although the existence of the latter is somewhat doubtful. Corresponding to the first of these are three acids, known as *orthophosphoric* (tribasic phosphoric), H_3PO_4, *pyrophosphoric*, $H_4P_2O_7$, and *metaphosphoric*, HPO_3. Orthophosphoric acid is formed by dissolving P_2O_5 in boiling water, or by the action of nitric acid upon phosphorus itself; pyrophosphoric acid, by the heating of the tribasic phosphoric acid to 213° C. (415.4° F.); and metaphosphoric acid, by the ignition of the tribasic variety, or by dissolving P_2O_5 in cold water. *Phosphorous acid*, H_3PO_3, cannot be formed directly from phosphorous oxide. This is a dibasic acid, containing one hydrogen atom not replaceable by metal. *Hypophosphorous acid*, H_3PO_2, is not capable of being derived directly from hypophosphorous oxide. It is monobasic, containing two hydrogen atoms not replaceable by metal.

Tests for Phosphates and Phosphoric Acids.

1. Solution of silver nitrate produces a yellow precipitate with a neutral solution of an orthophosphate, soluble both in nitric acid and in ammonia. It produces a white precipitate with pyrophosphoric acid or metaphosphoric acid.

2. If albumen be added to metaphosphoric acid, or to a solution of a metaphosphate containing acetic acid, a white precipitate is produced. No precipitate occurs if it be added to pyrophosphoric acid or orthophosphoric acid.

3. Official test-solution of magnesium (see Tests) produces with phosphoric acid or a solution of a phosphate a precipitate of ammonio-magnesium phosphate.

4. If solution of ammonium molybdate in diluted nitric acid be added in excess to phosphoric acid or to a solution of a phosphate in nitric acid, and heat applied, a yellow precipitate of ammonium phosphomolybdate will be produced.

5. If a solution of barium chloride be added to a neutral solution of a phosphate, a white precipitate of barium phosphate is produced, which is soluble in acids.

Tests for Hypophosphites.

1. When heated, they evolve spontaneously inflammable hydrogen phosphide.

2. An acid solution of potassium permanganate is decolorized.

3. From solution of mercuric chloride, mercury is precipitated upon the addition of a solution of a hypophosphite.

Phosphorus. *U. S.*	Odor and Taste.	Solubility.	
		Water.	Other Solvents.
A translucent, nearly colorless solid, of a waxy lustre, having, at the ordinary temperature, about the consistence of beeswax. By long keeping, the surface becomes red, and occasionally black. It melts at 44° C. (111.2° F.). Sp. gr. 1.830 at 10° C. (50° F.).	Distinctive and disagreeable odor; distinctive and disagreeable taste. (Should not be tasted, except in a state of great dilution.)	Insoluble.	Soluble in 350 parts of absolute alcohol at 15° C. (59° F.), in 240 parts of boiling absolute alcohol, in 80 parts of absolute ether, in about 50 parts of any fatty oil, and very soluble in chloroform or carbon disulphide, the latter yielding a solution which must be handled with the greatest care to prevent danger from fire.

Tests for Identity.	Impurities.	Tests for Impurities.
When exposed to the air, it emits white fumes, which are luminous in the dark, and have an odor somewhat resembling that of garlic. On longer exposure to air, it takes fire spontaneously.	Arsenic.	Add 3 Gm. of Phosphorus to 15 C.c. of nitric acid diluted with 15 C.c. of distilled water in a flask having the capacity of 50 C.c., and digest the mixture at a gentle heat on a water-bath, until the Phosphorus is dissolved. Transfer the solution to a capsule, and evaporate it until no more nitrous vapors are given off, and then dilute the solution to 30 C.c. with distilled water. Heat 20 C.c. of the diluted solution to about 70° C. (158° F.) for half an hour, passing hydrogen sulphide through it during the half hour's heating, and then until the liquid has become cold. If the liquid be now allowed to stand at rest during twenty-four hours, not more than a very small quantity of lemon-yellow precipitate should be visible (limit of arsenic).
	Sulphur.	On adding barium chloride T.S. to the remainder of the liquid, not more than a slight opalescence should be produced (limit of sulphur).

Uses.—Phosphorus is administered internally, in doses of $\frac{1}{100}$ of a grain (0.0006 Gm.), as a nervous stimulant. In large doses it is poisonous. Its value in this connection depends upon its being administered in a free state. The oxide of phosphorus, phosphoric acid, does not have the same action: hence all pharmaceutical preparations of phosphorus must be protected from ox dation. (See Pilulæ Phosphori.)

OLEUM PHOSPHORATUM. *U.S.* Phosphorated Oil.

	Metric.	Old form.
Phosphorus	1 Gm.	4 grains.
Expressed Oil of Almond,		
Ether, each, a sufficient quantity,		
To make	100 Gm.	1 fl. oz.

Introduce a sufficient quantity of Expressed Oil of Almond into a flask, heat it on a sand-bath to 250° C. (482° F.), and keep it at that temperature for fifteen minutes. Then allow it to cool, and filter it. Put 90 Gm. [old form 7 fl. dr.] of the filtered Oil together with the Phosphorus, previously well dried by filtering paper, into a dry, tared bottle capable of holding about 120 C.c. [old form 2 fl. oz.], insert the stopper, and heat the bottle in a water-bath until the Phosphorus melts. Then agitate it until the Phosphorus is dissolved, allow it to cool, add enough Ether to make the mixture weigh 100 Gm. [or measure, old form, 1 fl. oz.], and agitate it again. Lastly, transfer the solution to small glass-stoppered vials, which should be completely filled and kept in a cool and dark place.

The object of this preparation is to administer phosphorus in minute doses, dissolved in a bland oil. When fresh, it is a clear and colorless or slightly colored oil, not phosphorescent in the dark, and having the odor and taste of phosphorus quite distinctly. The object of heating the oil is to expel air and traces of water, which would aid in oxidizing the phosphorus. The ether not only assists in the preservation of the finished preparation, but is of use in rendering the oil less disagreeable to the taste. It may be administered in the form of an emulsion, preferably the official almond emulsion, and flavored with oil of bitter almond, or in capsules: each minim contains about $\frac{1}{115}$ of a grain of phosphorus. The dose of the U. S. solution is from three to five minims (0.18 to 0.3 C.c.).

QUESTIONS ON CHAPTER XXXV.

SULPHUR AND PHOSPHORUS.

Give the symbol and atomic weight of sulphur.
Where does it come from, and how is it prepared?
What is roll-sulphur?
In what forms is sulphur official?
What gas is formed by it in combination with hydrogen?
For what is this gas used?
What are sulphides?
What are salts, called sulpho-salts by Berzelius?
What combination does sulphur form with oxygen?
What do these oxides form by their union with water?
Give their formulas in symbols.
What is hyposulphurous acid?
Is there an oxide corresponding to this acid?
What is thiosulphuric acid?
What acids are known as the thionic series of acids?
What are the salts which sulphurous acid forms with bases called, and what those which are similarly produced from sulphuric acid?
Which are more important salts, sulphates or sulphites?
What are the tests for sulphites and sulphurous acid? For sulphates and sulphuric acid?
What is sublimed sulphur?
What are its physical properties?
How is it used medicinally, and what is the dose?
How is washed sulphur prepared?
What is the use of adding ammonia in washing it?
At what temperature does it melt?
How may impurities of free acid be detected? Of arsenous sulphide? Of arsenous acid?
Why is washed sulphur preferred for medicinal purposes?
What is the dose?
In what official preparations is it used?
How is precipitated sulphur prepared?
Explain the reaction that takes place between lime and sulphur in the above process.
What would be the result if sulphuric acid were used instead of hydrochloric acid to precipitate the sulphur?
What is the popular name of this preparation?
How may the following impurities be detected?—viz.: free acid; calcium sulphate; alkalies, alkaline earths, or sulphide; arsenous sulphide; arsenous acid.
For what uses is precipitated sulphur preferable to other forms of sulphur?
What is the dose?
How is sulphur iodide prepared?
What is it called chemically?
Is it a definite chemical compound?
How may it be tested?
What is its use?
Carbon disulphide—Give formula in symbols and molecular weight.
How is it prepared, and how may it be purified?
What are its physical properties?
What is its specific gravity?
How may the following impurities be detected?—viz.: sulphurous acid; sulphur; hydrogen sulphide.
For what is it used? Is it ever used internally?
Phosphorus—Give symbol and atomic weight.
What is phosphorus, and how is it prepared?
How is acid calcium phosphate obtained?
Explain the reaction which takes place in its formation.
How is red phosphorus, or amorphous phosphorus, obtained?
What are its peculiar properties?

What oxides does phosphorus form with oxygen?
Give their formulas in symbols.
What three acids correspond to phosphoric oxide?
How is orthophosphoric acid formed?
What is its formula in symbols?
How is pyrophosphoric acid obtained?
Give its formula in symbols.
How is metaphosphoric acid obtained?
Give its formula in symbols.
Can phosphorous acid be formed directly from phosphorous oxide?
What is the character of its basicity?
Can hypophosphorous acid be obtained directly from hypophosphorous oxide?
What is the character of its basicity?
What are the tests for phosphates and phosphoric acid?
What are the tests for hypophosphites?
What is the specific gravity of phosphorus? What is its melting-point?
How may impurities be detected?—Sulphur; arsenic.
What is its medicinal action, and what is the dose?
Upon what does its value depend?
Does phosphoric acid have the same action?
Give the formula for phosphorated oil.
What is the object of this preparation?
How may it be administered?
What is the dose?
How much phosphorus is there in 5 minims?

CHAPTER XXXVI.

CARBON, BORON, AND SILICON.

C; 11.97. B; 10.9. Si; 28.3.

THESE three elements present some analogies, and, although the number of pharmaceutical preparations made from them is not great, they are of considerable interest.

Official Preparations of Carbon, Boron, and Silicon.

Carbo Animalis.—Prepared by burning bones out of contact with air.
Carbo Animalis Purificatus.—Made by purifying animal charcoal with HCl.
Carbo Ligni.—Made by burning wood out of contact with air.
Carbonei Disulphidum.—See preparations of sulphur.
Acidum Boricum.—Made by purifying the natural product.
Sodii Boras.—See preparations of soda.
Liquor Sodii Silicatis.—Made by fusing silica with dried sodium carbonate and dissolving the product.

Carbon. C; 11.97.

Carbon is a very widely diffused element. It is a constituent of all organic substances, and is found in nature in the form of the diamond, graphite, plumbago, coal, etc.

Two compounds with oxygen are known,—carbon dioxide, CO_2, and carbon monoxide, CO.

Carbon dioxide, CO_2, is a colorless, odorless gas, with a slightly acid taste, heavier than ordinary air. It is not combustible, and not a supporter of combustion; indeed, it is used extensively in fire-extinguishers and other contrivances to extinguish flame. Water is capable of absorbing its own volume of carbon dioxide, but many times its volume under pressure. This solution was formerly officinal, under the name of *Aqua Acidi Carbonici*, or carbonic acid water, the well-known "*soda water.*"

Carbonic acid, H_2CO_3, is produced when carbon dioxide is brought in contact with water.

$$\underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Carbonic Acid.}}{H_2CO_3}.$$

The salts known as carbonates are widely diffused in nature, and many chemical processes are based upon the decomposition of carbonates by strong acids. Carbonic acid, although present everywhere, is one of the weakest acids known.

Carbon monoxide, CO, is of little interest in pharmacy.

The compounds of carbon and hydrogen are very numerous, and of great importance. They are mostly obtained from organic substances, and will be considered under Part IV. With nitrogen, carbon forms cyanogen, the compound radical of hydrocyanic or prussic acid.

Tests for Carbonates.

1. Decompose by the addition of a strong acid, and pass the gas through lime-water. Insoluble calcium carbonate is formed.
2. The solutions of many of the salts of the metals, like iron, copper, lead, etc., are precipitated by the soluble carbonates.

CARBO ANIMALIS. *U.S.* Animal Charcoal.

C; 11.97.

Preparation.—Animal charcoal is made by subjecting bones to a red heat in close vessels.

Bone consists of animal matter with calcium phosphate and carbonate. In consequence of the decomposition of the animal matter involved by the destructive distillation, the nitrogen and hydrogen, united as ammonia, distil over, while the greater part of the carbon is left in the cylinder, intermingled with the calcium salts.

The charcoal is termed *bone-black* or *ivory-black*, and in manufacturing it the bones are boiled in water, to separate the fat, before being subjected to destructive distillation in the iron cylinders. These are connected with vessels which receive the ammoniacal liquor, called *bone-spirit*, together with a dark tarry liquid (*bone-oil*).

Official animal charcoal is in dull-black, granular fragments, or a dull-black powder, odorless and nearly tasteless, and insoluble in water or in alcohol. When ignited, it leaves a white ash, amounting to at least 85 per cent. of the original weight, which should be completely soluble in hydrochloric acid, with the aid of heat.

Uses.—Animal charcoal is used to deprive substances of color (see Decoloration, page 233).

CARBO ANIMALIS PURIFICATUS. *U.S.* Purified Animal Charcoal.

	Metric.	Old form.
Animal Charcoal, in No. 60 powder	100 Gm.	16 oz. av.
Hydrochloric Acid	300 Gm.	40 fl. oz.
Boiling Water, a sufficient quantity.		

Introduce the Animal Charcoal into a capacious flask, add 200 Gm. [old form 26 fl. oz.] of Hydrochloric Acid, and 100 C.c. [old form 15 fl. oz.] of Boiling Water, and connect the flask with an upright condenser. By means of a sand-bath keep the mixture gently boiling during eight hours. Then add 500 C.c. [old form 4½ pints] of Boiling Water, transfer the mixture to a muslin strainer, and, when the liquid has run off, return the Charcoal to the flask. Add to it 100 C.c. [old form 14 fl. oz.], each, of Hydrochloric Acid and of Boiling Water, boil for two hours, again add 500 C.c. [old form 4½ pints] of Boiling Water, transfer the whole to a plain filter, and, when the liquid has run off, wash the residue with Boiling Water until the washings give

only a faint cloudiness with silver nitrate test-solution. Dry the powder in a drying oven, and immediately transfer to well-stoppered vials.

The object of purifying animal charcoal by treatment with hydrochloric acid is to separate the calcium phosphate and carbonate which are invariably present in the crude bone-black. In some decolorizing operations these impurities are harmless, but in many delicate chemical processes they may be dissolved or decomposed, and thus seriously contaminate the products which the charcoal is intended to purify.

Official purified animal charcoal is a dull-black powder, odorless and tasteless, and insoluble in water, alcohol, or other solvents. When ignited at a high temperature with a little red mercuric oxide, and with free access of air, it leaves at most only a trace of residue. Complete carbonization is shown by the official test:

"If 1 Gm. of the powder be boiled with a mixture of 3 C.c. of potassium hydrate T.S. and 5 C.c. of water during three minutes, the filtrate should be colorless."

CARBO LIGNI. *U.S.* Charcoal.

Preparation.—Charcoal prepared from soft wood is preferred for medical purposes. It is made by burning wood out of contact with air, either in iron cylinders or in stacks. In the former case, the volatile products resulting from the destructive distillation are collected by condensation, and contribute valuable products to pharmacy (see Acidum Aceticum). In the latter, the charcoal is made in the neighborhood of a cheap wood-supply. Billets of wood are piled in a conical form, and covered with earth and sod to prevent the free access of air, several holes being left at the bottom and one at the top of the pile in order to produce a draught to commence the combustion. The wood is kindled from the bottom, and soon after ignition the hole at the top is closed, and when the wood is all ignited the holes at the bottom are stopped. The result is that the volatile portions of the wood, hydrogen, oxygen, water, etc., are dissipated, carbon being left.

Uses.—Charcoal is used in medicine as an absorbent and disinfectant. It is given in the form of powder, in doses of one to two drachms (3.8 to 7.7 Gm.). Owing to its absorbent powers, it should never be kept exposed to the air, as it will become unfit for use if subjected to the atmosphere of a laboratory or pharmacy. Tin cans with tightly-fitting covers are appropriate containers.

Boron. B; 10.9.

Boron, like carbon, exists in three allotropic conditions,—amorphous, crystallized, and graphitoidal. Boron combines with hydrogen and oxygen, and boric (or boracic) acid is produced, H_3BO_3, the principal salt of which is Sodii Boras, or borax (see page 562).

Tests for Borates and Boric Acid.

1. A colorless flame is tinged green by an alcoholic solution of boric acid.

2. A solution of a borate, if slightly acidified by hydrochloric acid, turns the yellow color of turmeric paper brown, if the paper is allowed to dry.

Unofficial Preparations of Boron.

Acidum Metaboricum, HBO_2, **Metaboric Acid.**	By heating boric acid to 38° C. (100° F.).
Acidum Pyroboricum, $H_2B_4O_7$, **Pyroboric Acid.**	By heating boric acid for a long time to 60° C. (140° F.).
Boron Trisulphidum, B_2S_3, **Boron Trisulphide.**	By heating boron in the vapor of sulphur and collecting the resulting white mass.

ACIDUM BORICUM. *U.S.* Boric Acid (Boracic Acid).

H_3BO_3; 61.78.

Preparation.—The lagoons of the volcanic districts of Tuscany formerly furnished the greater part of the boric acid and borax of commerce. Borax is now found native in California, and boric acid is produced by decomposing borax with hydrochloric acid.

$$\underset{\text{Sodium Borate.}}{Na_2B_4O_7 10H_2O} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Boric Acid.}}{4H_3BO_3} + \underset{\text{Water.}}{5H_2O}.$$

Boric acid is required in very fine powder for most medical uses.

Acidum Boricum. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Transparent, colorless, somewhat pearly lustre, or, when in perfect crystals, six-sided, triclinic plates, slightly unctuous to the touch, permanent in the air. The addition of hydrochloric acid increases its solubility in water.	Odorless; coolish, bitterish; feebly acid in solution, turning blue litmus paper red, and turmeric paper brownish-red after drying, even when the solution is acidulated with hydrochloric acid: this color is changed to bluish-black by ammonia water.	Cold, 25.6 parts. Boiling, 3 parts.	Cold, 15 parts. Boiling, 5 parts.	Glycerin, 10 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated to 100° C. (212° F.), Boric Acid loses water, metaboric acid (HBO_2) is formed and slowly volatilizes at that temperature. Heated to 160° C. (320° F.), it fuses to a glassy mass of tetraboric (or pyroboric) acid ($H_2B_4O_7$); at a higher temperature, the fused mass swells up, loses all of its water, and becomes boron trioxide (B_2O_3), which fuses into a transparent, non-volatile mass. The alcoholic or glycerin solution burns with a flame tinged with green; from a boiling solution the acid readily volatilizes.	Iron.	In a solution of 1 Gm. of Boric Acid in a mixture of 1 C.c. of hydrochloric acid and 49 C.c. of water, 0.5 C.c. of potassium ferrocyanide T.S. should not at once produce a blue color.
	Sulphate.	A 2-per-cent. aqueous solution of the Acid should not be precipitated by barium chloride T.S.
	Chloride.	Silver nitrate T.S. with nitric acid.
	Lead, Copper, Iron, etc.	Ammonium sulphide T.S.
	Calcium.	Ammonium oxalate T.S.
	Ammonia.	No odor of ammonia should be evolved by heating the acid with potassium or sodium hydrate T.S.
	Sodium Salt.	A fragment heated on a clean platinum wire in a non-luminous flame should not impart a persistent yellow color.
	Magnesium.	Sodium phosphate T.S. and ammonia water.

Uses.—Boric acid is used in what is known as antiseptic surgery, and externally in the form of an ointment. It is added in small quantities to various liquids, to prevent fermentation. It is well adapted for such uses, as it communicates but little taste. It has not been proved to be innocuous, however, and therefore should be sparingly used. (See Boroglycerinum, Part VI.; also Glyceritum Boroglycerini, p. 320.)

Silicon. Si; 28.3.

Very few of the compounds of the non-metallic element silicon are used medicinally. Silicon, like carbon and boron, is obtained in three allotropic states,—amorphous, crystalline, and graphitoidal. In some of its combinations, notably in glass, earthen-ware, china, mortar, and cements of various kinds, it is of vast importance commercially. Silicon is found in nature combined with aluminum, magnesium, or calcium, in *pumice-stone*, *meerschaum*, *asbestos*, *talcum*, *soapstone*, etc.; or as an anhydride (silica), in *sand*, *flint*, *agate*, *quartz*, etc.

Silica, SiO_2, may be obtained in a pure condition by treating official solution of sodium silicate with hydrochloric acid.

$$\underset{\text{Sodium Silicate.}}{Na_2SiO_3} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Silica.}}{SiO_2} + \underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Water.}}{H_2O}.$$

Test for Silicates.

Silicates are insoluble in most reagents. If the soluble sodium and potassium silicates, in aqueous solution, be neutralized with hydrochloric acid, and ammonia water be added in excess, a gelatinous precipitate of silicic hydrate will separate.

LIQUOR SODII SILICATIS. *U.S.* Solution of Sodium Silicate.

Preparation.—Sodium silicate (Na_2SiO_3), or *soluble glass*, is made by fusing one part of fine sand and two parts of dried sodium carbonate, mixed in powder, in an earthen-ware crucible, and pouring out the fused mass on a stone slab to cool. This is pulverized, and treated with boiling water, to dissolve the soluble part. The solution is filtered and concentrated: crystals may be formed upon evaporation, if desired.

The salt is used commercially entirely in solution. This usually contains about 20 per cent. of silica and 10 per cent. of soda.

Liquor Sodii Silicatis. *U.S.*	Odor, Taste, and Reaction.	Tests for Identity.
A semi-transparent, almost colorless, or yellowish, or pale greenish-yellow, viscid liquid. Sp. gr. between 1.300 and 1.400 at 15° C. (59° F.).	Odorless; sharp, saline, and alkaline taste; alkaline reaction.	A drop of the Solution, when held in a non-luminous flame, imparts to it an intensely yellow color. If a portion of the Solution, largely diluted with water, be supersaturated with nitric acid, a gelatinous or pulverulent, white precipitate of silicic hydrate will be produced.

Uses.—This solution is used in surgery in preparing mechanical dressings.

QUESTIONS ON CHAPTER XXXVI.

CARBON, BORON, AND SILICON.

Carbon—Give symbol and atomic weight.
In what forms is carbon found in nature?
What compounds with oxygen are known? Give their formulas.
What are the physical properties of carbon dioxide?
What is carbonic acid? Is it a strong acid?
What is carbon monoxide?
What is cyanogen?
What are the tests for carbonates?
How is animal charcoal made?
What is the composition of bone?
What are the products when bones are subjected to destructive distillation?
Describe official animal charcoal.
For what purpose is it used?
How is "purified animal charcoal" made?
What is the object of purifying animal charcoal?
How is charcoal prepared?
What is its medicinal use? What is the dose?
Boron—Give symbol and atomic weight.
In what forms does boron exist?
What combination of it is formed with oxygen and hydrogen?
What are the tests for borates and boric acid?
What is boric acid? What is its synonyme? Give symbol and atomic weight.
How is it prepared? Where does it come from?
What chemical reaction takes place when borax is decomposed by hydrochloric acid?
How may the following impurities be detected?—viz.: sulphate; chloride; lead, copper, iron, etc.; calcium; sodium salt.
What are the uses of boric acid?
Silicon—Give symbol and atomic weight.
In what forms is silicon obtained?
In what combinations is it important, commercially?
How is it found in nature?
What is silica, and how may it be obtained pure?
Give the chemical reaction when official solution of sodium silicate is treated with hydrochloric acid.
What are the tests for silicates?
How is solution of sodium silicate prepared?
What is the usual strength of the solution?
For what is it used?

CHAPTER XXXVII.

THE ALKALIES AND THEIR COMPOUNDS.

Potassium, Sodium, Lithium, and Ammonium.

K; 39.03. Na; 23. Li; 7.01. NH_4; 18.01.

THE alkalies are bodies having strongly-marked physical and chemical properties: 1. They combine with acids to form salts. 2. They restore the color of reddened litmus paper, and change the colors of vegetable blues to green, and of vegetable yellows to brown. 3. Their taste is never sour, but it is characteristic, and caustic if the alkali is in concentrated solution. The salts formed by their combinations with acids possess acid, alkaline, or neutral reactions according to the relative strength and proportion of the component parts.

The metals known as alkali-metals which form compounds of pharmaceutical interest are potassium, sodium, and lithium. They are all univalent, and of a white color resembling that of silver, and are so prone to oxidation that they must be kept constantly immersed in some carbo-hydrogen or body free from oxygen, like naphtha or petroleum. They are so soft that they can be easily cut with a penknife. They float upon water, and inflame spontaneously and immediately when brought in contact with it.

The alkali-metals are often called light metals, on account of their low specific gravity when compared with the others.

Their carbonates are all soluble in water, and each metal forms but one chloride.

Their oxides are strongly basic, restoring the color of reddened litmus quickly. The oxides are also very soluble in water, forming caustic and powerfully alkaline hydrates, which cannot be decomposed by heat.

Their sulphates, phosphates, nitrates, sulphides, chlorides, bromides, iodides, and nearly all their salts, are soluble in water, are almost without exception colorless, or of an opaque white color, and many of them, if heated to redness, fuse without decomposition.

The processes for obtaining the metals are very similar, and consist in exposing their carbonates, intimately mixed with finely-powdered charcoal, in suitable iron vessels, to an intense heat: carbon monoxide is liberated, and the vapors of the metals are condensed in flattened receivers.

Ammonium is a compound radical, NH_4, but has so many analogies with the alkali-metals that it is classed with them.

CHAPTER XXXVIII.

THE POTASSIUM SALTS.

THE salts of potassium are among the most important of any that are used in medicine. They are generally very soluble, and, with a few exceptions, are colorless or of an opaque white color. The sole source of the potassium salts was formerly wood-ashes, but at present cheaper sources have been discovered. The wood-ashes were lixiviated, the liquid containing the soluble salts evaporated to dryness, and the residue allowed to cool. This constituted the crude *potash* of commerce.

Potash is now made from the ashes from beet-sugar residues, from *suint*, the residue obtained by evaporating the water used to scour the fleeces of sheep, and from an impure potassium chloride obtained from the Stassfurt mines in Germany, which is now the principal source of the potassium compounds.

The salts are converted into potassium sulphate, and this into carbonate by heating with coal and limestone. For the purpose of converting the sulphate into the carbonate, it is heated in a reverberatory furnace with the proper quantity of coal and limestone, with the coal in order to form potassium sulphide, and with the limestone to convert the sulphide into carbonate, the sulphur uniting with the calcium to form calcium sulphide. The mass, after cooling, is lixiviated with water, and this solution of impure potassium carbonate is filtered to separate the insoluble calcium sulphide, and subsequently treated with milk of lime, by which insoluble calcium carbonate is precipitated, and potassium hydrate in solution remains. The liquid is then evaporated to dryness.

Tests for Potassium Salts.

Potassium may be recognized in its combinations by the following tests:

1. The addition of platinic chloride with a little alcohol and a few drops of hydrochloric acid produces a yellow crystalline precipitate, $PtCl_4 2KCl$ (double platinum and potassium chloride.

2. With an excess of a concentrated solution of tartaric acid, a white crystalline precipitate is slowly formed when a strong solution of a potassium salt is added with stirring. This is the well-known acid potassium tartrate (cream of tartar).

3. A colorless flame is tinted violet by pure potassium salts.

4. Potassium salts are soluble in water, and not volatile at a red heat.

Official Potassium Salts and Preparations.

Officinal Name.	Preparation.
With Inorganic Radicals.	
Potassa	From the ashes of plants, etc., by lixiviating, concentrating the solutions, evaporating to dryness, purifying by treating a dilute solution with lime, evaporating, fusing, and casting into moulds.
Potassa cum Calce	By mixing equal parts of well-dried potassa and lime together.
Liquor Potassæ	About 5 per cent. solution of potassium hydrate made by dissolving the hydrate in water.
Potassa Sulphurata	By melting potassa and sulphur together in a crucible, pouring the liquid on a slab, and cooling.
Potassii Bicarbonas	By passing carbon dioxide into a solution of carbonate, evaporating and crystallizing.
Potassii Bichromas	By treating potassium chromate with sulphuric acid, evaporating and crystallizing.
Potassii Bromidum	By treating solution of potassa with bromine and charcoal.
Potassii Carbonas	By purifying pearl-ash by dissolving it in water, filtering, evaporating, and granulating.
Potassii Chloras	By reacting on potassium chloride with calcium hypochlorite.
Potassii Cyanidum	By fusing potassium ferrocyanide with potassium carbonate, separating the insoluble precipitate of metallic iron, and pouring the fused mass on a slab.
Potassii Ferrocyanidum	By heating nitrogenized substances with iron and potassa.
Potassii Hypophosphis	By precipitating calcium hypophosphite with potassium carbonate.
Potassii Iodidum	By treating solution of potassa with iodine, evaporating to dryness, and heating with charcoal.
Potassii Nitras	By decomposition of sodium nitrate with potassium chloride.
Potassii Permanganas	By heating together manganese dioxide, potassium chlorate, and potassa.
Potassii Sulphas	By purifying the residue from nitric acid manufacture, and from other sources.
Liquor Potassii Arsenitis	By boiling potassium bicarbonate with arsenous acid, and adding a small quantity of compound tincture of lavender.
Trochisci Potassii Chloratis	Each troche contains five grains of potassium chlorate, with spirit of lemon, sugar, tragacanth, and sufficient water to form a mass.
With Organic Radicals.	
Potassii Acetas	By decomposing potassium bicarbonate with acetic acid, and evaporating the filtered solution, carefully avoiding contact with iron.
Potassii Bitartras	By purifying argols, the sediment deposited in wine-casks during fermentation.
Potassii Citras	By decomposing potassium bicarbonate with citric acid, evaporating and granulating.
Potassii Citras Effervescens	By powdering citric acid, potassium bicarbonate, and sugar together, drying the paste rapidly, and finally powdering.
Potassii et Sodii Tartras	By treating solution of potassium bitartrate with sodium carbonate.
Liquor Potassii Citratis	8 parts of potassium bicarbonate with 6 parts of citric acid in 100 parts of water.

Unofficial Potassium Salts and Preparations.

Names.	Preparation.
Potassii Antimonias, $KSbO_3$. Potassium Antimoniate.	Deflagrating 1 p. metallic antimony with 4 p. potassium nitrate, and lixiviating with water.
Potassii Bisulphas, $KHSO_4$. Potassium Bisulphate.	Residue remaining in retort on preparing nitric acid from potassium nitrate and sulphuric acid.
Potassii Bisulphis, $KHSO_3$. Potassium Bisulphite.	Passing an excess of sulphurous acid gas into a concentrated solution of potassium carbonate.
Potassii Borotartras. Potassium Borotartrate.	Dissolve by heat 4 p. potassium bitartrate, and 1 p. boric acid in 10 p. water, and evaporate to dryness.
Potassii Chloridum, KCl. Potassium Chloride.	Obtained as a by-product in many salts.
Potassii Chromas, K_2CrO_4. Potassium Chromate.	Add potassium carbonate to a hot solution of bichromate until effervescence ceases.
Potassii et Ammonii Tartras, $KNH_4C_4H_4O_6$. Potassium and Ammonium Tartrate.	Diffuse 1 p. potassium bitartrate in 3 p. boiling water; then add ammonium carbonate until effervescence ceases; filter and crystallize.
Potassii et Sodii Borotartras. Potassium and Sodium Borotartrate.	Dissolve 2 p. sodium borate in 20 p. distilled water, and digest with 5 p. potassium bitartrate.
Potassii Ferricyanidum, $K_6Fe_2Cy_{12}$. Potassium Ferricyanide.	Pass chlorine gas into a cold solution of potassium ferrocyanide until it ceases to produce a blue precipitate with ferric chloride.
Potassii Iodas, KIO_3. Potassium Iodate.	Pass chlorine gas into cold water containing iodine in suspension until wholly dissolved; then add potassium chlorate and warm. Dose, 4 to 8 grains (0.3 to 0.5 Gm.).
Potassii Iodohydrargyras, $(2KI.HgI_2)3H_2O$. Potassium Iodohydrargyrate (Potassio-Mercuric Iodide).	Dissolve 3 p. mercuric iodide in a concentrated solution of potassium iodide containing 2 p. of the salt; when cool, yellow prisms will deposit from the mother-liquid. Dose, one-twelfth of a grain (0.005 Gm.).
Potassii Nitris, KNO_2. Potassium Nitrite.	Made by heating the nitrate to redness and separating undecomposed nitrate; by dissolving the fused mass in water the nitrate will crystallize out; the mother-liquor is treated with diluted acetic acid and twice its volume of alcohol, to separate more nitrate. The nitrite may be obtained by evaporating the solution over sulphuric acid. Dose, 3 grains (0.194 Gm.).
Potassii Perchloras, $KClO_4$. Potassium Perchlorate.	Heat potassium chlorate until it melts; keep at this temperature until gas ceases to be evolved, and a portion tested with strong HCl acquires only a faint yellow color. Purify.
Potassii Platinocyanidum, $2KCN.Pt(CN)_2.3H_2O$. Potassium Platinocyanide.	Mix concentrated solutions of 1 p. exsiccated platinic chloride and 2 p. potassium cyanide; heat until the precipitate is redissolved.
Potassii Pyrosulphis, $K_2(SO)_2O$. Potassium Pyrosulphite.	Pass sulphurous acid gas into a warm, saturated solution of potassium carbonate; on cooling, it deposits crystals.
Potassii Salicylas, $(KC_7H_5O_3)_2.H_2O$. Potassium Salicylate.	Dissolve 7 p. potassium bicarbonate in water; then add gradually 10 p. salicylic acid, and evaporate.
Potassii Silicas, K_2SiO_3. Soluble glass.	Fuse 10 p. potassium carbonate, 15 p. fine sand, and 1 p. charcoal.
Potassii Sulphidum, K_2S. Potassium Sulphide.	Pass hydrogen sulphide gas into a solution of potassa as long as it is absorbed, and add an equal bulk of potassa solution; evaporate.
Potassii Sulphis. Potassium Sulphite.	Pass sulphurous acid gas through a solution of potassium carbonate.
Potassii Sulphocarbonas, K_2CS_3. Potassium Sulphocarbonate.	Mix a solution of potassium sulphide with carbon disulphide; on evaporation, orange-yellow crystals are deposited.
Potassii Sulphocyanas, $KSCN$. Potassium Sulphocyanate.	Melt together 17 p. potassium carbonate, 32 p. sulphur, and 46 p. anhydrous potassium ferrocyanide, and heat to low redness. When cool, treat with boiling alcohol.
Potassii Tartras. Potassium Tartrate.	By treating solution of potassium bitartrate with potassium carbonate.
Mistura Potassii Citratis, U.S. P. 1880. Neutral Mixture.	By neutralizing 100 parts of lemon juice with 10 parts of potassium bicarbonate.

POTASSA. *U. S.* Potassa.

KOH; 55.99.

[Potassium Hydrate. Potassium Hydroxide. Caustic Potash.]

Preparation.—Potassa, called commercially caustic potash, is made by evaporating a solution of potassium hydrate rapidly in a silver or clean iron vessel until a fluid of oily consistence remains, a drop of which, when removed on a warm glass rod, solidifies on cooling. The hot caustic potassa is poured into cylindrical moulds, and while the sticks are still warm they are bottled quickly, to prevent deliquescence.

Pure caustic potassa is sometimes prepared in the form of powder by stirring the fused mass rapidly with a silver spatula until a granulated powder is formed. This must be placed in warm dry bottles and quickly sealed hermetically.

Potassa by Alcohol and *Potassa by Barytes* are terms used to designate pure caustic potassa made by purifying with alcohol and barium hydroxide, alcohol dissolving only the caustic potassa, whilst the sulphate is separated by treatment with baryta-water, forming the insoluble barium sulphate.

Potassa. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvent.
Dry, white, translucent pencils, or fused masses, hard and brittle, showing a crystalline fracture. Great caution is necessary in tasting and handling it, as it rapidly destroys organic tissues. Exposed to the air, it rapidly absorbs carbon dioxide and moisture, and deliquesces. When heated to about 530° C. (986° F.), Potassa melts to a clear, oily liquid, and at a bright red heat it is volatilized unchanged. When introduced into a non-luminous flame, it imparts to it a violet color.	Odorless, or having a faint odor of lye; very acrid and caustic taste; strongly alkaline reaction.	At 15° C. (59° F.), in about 0.5 part. Boiling, Very soluble.	At 15° C. (59° F.), 2 parts. Boiling, Very soluble.	Slightly soluble in ether.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
After acidulation with hydrochloric acid it yields bright yellow precipitates with platinic chloride T.S. and with sodium cobaltic nitrite T.S.	Organic Matter.	An aqueous solution of Potassa should be colorless.
A concentrated aqueous solution, when dropped into solution of tartaric acid, produces a white, crystalline precipitate, which is redissolved by an excess of solution of Potassa.	Arsenic, Lead, etc.	If 1 Gm. of Potassa be dissolved in 10 C.c. of water, and slightly supersaturated with acetic acid, 10 C.c. of the solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S.,
	Iron, Aluminum, etc.	Nor by the subsequent addition of ammonia water in slight excess.
	Calcium.	The remainder of the acidulated solution should not be rendered turbid by ammonium oxalate T.S.
	Chloride Limit.	If a solution of 1.5 Gm. of Potassa in 10 C.c. of water be slightly supersaturated with nitric acid, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the addition of more silver nitrate V.S.

Test for Identity and Quantitative Test.	Impurities.	Tests for Identity.
To neutralize 0.56 Gm. of Potassa should require not less than 9 C.c. of normal sulphuric acid (each C.c. corresponding to 10 per cent. of pure potassium hydrate), phenolphtalein being used as indicator.	Sulphate.	If to a solution of 3.5 Gm. of Potassa in 10 C.c. of water, strongly supersaturated with hydrochloric acid, 0.1 C.c. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.
	Silicate.	If 1 Gm. of Potassa be dissolved in 2 C.c. of water, and added to 10 C.c. of alcohol, not more than a slight, colorless precipitate should occur within ten minutes.
	Carbonate.	After boiling this alcoholic solution with 5 C.c. of calcium hydrate T.S. and filtering, not the slightest effervescence should take place on adding the filtrate to an excess of diluted hydrochloric acid.
	Nitrate.	If 0.2 Gm. of Potassa be dissolved in 2 C.c. of water, and carefully mixed with 4 C.c. of pure sulphuric acid and 2 drops of indigo T.S., the blue color should not be discharged.
	More than 1.5 per cent. of Soda.	To test for *soda*, dissolve 0.56 Gm. of Potassa in 5 C.c. of water, add a few drops of phenolphtalein T.S., and then, from a burette, enough tartaric acid T.S. (3 Gm. in 20 C.c.) to accurately neutralize the solution. Next add another volume of the tartaric acid T.S. equal to that first used, and then enough absolute alcohol to completely precipitate the potassium bitartrate formed. Separate the precipitate by filtration, and wash it with a little alcohol. The filtrate should not require more than 0.2 C.c. of normal potassium hydrate V.S. to restore the red color.

Uses.—Potassa is used as a caustic, principally, however, in veterinary practice: the end of the stick may be wrapped several times with tin-foil, to avoid cauterizing the finger of the operator. When this form of potassium hydrate is used for making official solution of potassa, care should be taken to allow for the moisture contained in it: commercial caustic potassa rarely contains less than 30 per cent. of water.

POTASSA CUM CALCE. *U.S.* Potassa with Lime.

	Metric.	Old form.
Potassa	500 Gm.	1 oz. av.
Lime	500 Gm.	1 oz. av.
To make	1000 Gm.	2 oz. av.

Rub them together, in a warm iron mortar, so as to form a powder, and keep it in a well-stoppered bottle.

This preparation is a grayish-white powder, deliquescent, having a strongly alkaline reaction, and responding to the tests for calcium and potassa. It should be soluble in hydrochloric acid without leaving more than a small residue. It should not effervesce on the addition of an acid. It is found in commerce moulded into sticks, which are often more convenient than the powdered form, because less deliquescent.

Uses.—Potassa with lime is used medicinally for the same purposes as caustic potassa: it is slower in its operation and more manageable than the latter.

LIQUOR POTASSÆ. *U. S.* Solution of Potassa.

[SOLUTION OF POTASSIUM HYDRATE.]

An aqueous solution of Potassium Hydrate [$KOH = 55.99$], containing about 5 per cent. of the hydrate.

	Metric.	Old form.
Potassium Bicarbonate	85 Gm.	2 oz. av. 410 gr.
Lime	40 Gm.	1 oz. av. 166 gr.
Distilled Water, a sufficient quantity.		

Dissolve the Potassium Bicarbonate in 400 C.c. [old form 12½ fl. oz.] of Distilled Water, heat the solution until effervescence ceases, and then increase the heat to the boiling point of the liquid. Slake the Lime with about 20 C.c. [old form 5 fl. dr.] of Distilled Water, then mix it well with 400 C.c. [old form 12½ fl. oz.] of Distilled Water, pour the mixture into a tared flask, and, having heated it to boiling, gradually add to it the solution of Potassium Bicarbonate, and boil during ten minutes. Then add enough Distilled Water to the flask to make the contents weigh 1000 Gm. [old form 2 pints], and set the flask aside, well stoppered, until the contents are cold. Lastly, strain the liquid through linen, set it aside in a well-stoppered bottle until it has become clear by subsidence, and separate the clear solution by decantation, or by means of a siphon.

Solution of Potassa may also be prepared in the following manner:

Alternative Process.

	Metric.	Old form.
Potassa	56 Gm.	1 oz. av.
Distilled Water	944 Gm.	1 pint.
To make	1000 Gm.	about 1 pint.

Dissolve the Potassa in the Distilled Water.

The Potassa used in this process should be of the full strength directed by the Pharmacopœia (90 per cent.). Potassa of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken; the proper amount for the above formula being ascertained by dividing 5000 by the percentage of absolute Potassa (potassium hydrate) contained therein.

Solution of potassa should be kept in bottles made of green glass and provided with glass stoppers coated with paraffin or petrolatum.

The potassium hydrate is obtained in the first formula by decomposing potassium bicarbonate through the action of calcium hydrate and heat. The direction to heat the solution of potassium bicarbonate until effervescence ceases is for the purpose of driving off as much of the carbonic acid as possible by the simplest method: the remainder is disposed of through double decomposition, as shown by the equation

$$\underset{\text{Potassium Carbonate.}}{K_2CO_3} + \underset{\text{Calcium Hydrate.}}{Ca(HO)_2} = \underset{\text{Potassium Hydrate.}}{2KHO} + \underset{\text{Calcium Carbonate.}}{CaCO_3}.$$

Preference is given to the bicarbonate as the source of the potassium, because the cheaper carbonates nearly always contain silicates and other impurities in sufficient quantities to render the product inferior.

The proportion of water is not a matter of indifference. The quantity used should be at least five times as great as that of the bicarbonate, and the lime must greatly exceed the amount indicated by theory. The sparing solubility of the lime sufficiently accounts for this.

It is advisable to strain the solution as rapidly as possible, merely to separate the bulk of the lime, and set it aside in tightly-covered jars until all sediment has deposited, and then decant the clear solution. This plan avoids the injurious contact of the air, by which carbonic acid is absorbed.

In the alternative formula ready-made potassa is used by simply dissolving it in water, the only advantages being those of greater convenience and the saving of labor and time.

Liquor Potassæ. U.S.	Odor, Taste, and Reaction.	Solubility.
A clear, colorless liquid. Sp. gr. about 1.036 at 15° C. (59° F.).	Odorless; very acrid and caustic taste; strongly alkaline reaction.	Miscible in all proportions with water and alcohol.

Tests for Identity and Quantitative Test.
It should conform to the same reactions and tests as an aqueous solution of Potassa. (See Potassa.)
To neutralize 28 Gm. of Solution of Potassa should require about 25 C.c. of normal sulphuric acid V.S. (each C.c. of the volumetric solution indicating 0.2 per cent. of absolute potassium hydrate), phenolphtalein being used as indicator.

Uses.—Solution of potassa is a valuable antacid when given in doses of twenty minims (1.2 C.c.), diluted with milk. If a large quantity should be swallowed accidentally, the proper antidotes would be mild acid liquids, like vinegar or lemon-juice, accompanied with bland oils.

POTASSA SULPHURATA. U. S. Sulphurated Potassa.

[Liver of Sulphur.]

	Metric.	Old form.
Sublimed Sulphur	100 Gm.	1 oz. av.
Potassium Carbonate, dried	200 Gm.	2 oz. av.
		3 oz. av.

Mix the powdered and dried Potassium Carbonate thoroughly with the Sublimed Sulphur, and gradually heat the mixture, in a covered crucible, which should be only about half filled with it, until the mass ceases to foam and is in a state of perfect fusion. Then pour the fused mass on a cold marble slab, and, after it has cooled, break it into pieces, and keep it in a well-stoppered bottle.

This preparation is not a definite chemical compound, as shown by its vague official name and the absence of a chemical formula. It is sometimes called *liver of sulphur*, and is a mixture of potassium hyposulphite and potassium sulphide, with probably some potassium pentasulphide

and traces of undecomposed potassium carbonate. The effervescence is caused by the escape of carbonic acid gas.

$$\underset{\text{Potassium Carbonate.}}{3K_2CO_3} + \underset{\text{Sulphur.}}{4S_2} = \underset{\text{Potassium Sulphide.}}{2K_2S_3} + \underset{\text{Potassium Hyposulphite.}}{K_2S_2O_3} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

This preparation should be *made by the pharmacist* in small quantities and dispensed in a fresh condition, as it is impossible to prevent deterioration. Potassium sulphide, which is its principal medicinal constituent, is converted, through oxidation, into inert potassium sulphate.

Potassa Sulphurata. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Irregular pieces of a liver-brown color when freshly prepared, turning gradually to greenish-yellow or brownish-yellow. The aqueous solution has an orange-yellow color and exhales the odor of hydrogen sulphide. The latter is abundantly evolved on the addition of acetic acid, while at the same time sulphur is deposited.	Faint, disagreeable odor; bitter, alkaline, repulsive taste; alkaline reaction.	2 parts, with the exception of a small residue.	Partly soluble in alcohol, leaving undissolved the accompanying impurities.

Test.	Quantitative Test.
If a solution of the salt be boiled with an excess of hydrochloric acid, until no more hydrogen sulphide is given off, the cold filtrate, after being neutralized with soda, yields a white crystalline precipitate with a saturated solution of sodium bitartrate.	On triturating together 1 Gm. of Sulphurated Potassa and 1 Gm. of crystallized copper sulphate with 10 C.c. of water, and filtering, the filtrate should remain unaffected by hydrogen sulphide T.S., corresponding to at least 12.85 p.c. of sulphur combined with potassium to form sulphide.

The addition of the solution of sodium bitartrate identifies the potassium salt by forming a white, crystalline precipitate of potassium bitartrate. The quantitative test depends for its action upon the decomposition of a certain amount of cupric sulphate. If the official percentage of potassium sulphide is present, the quantity of copper in the cupric sulphate taken will be entirely converted into sulphide, so that no discoloration will be caused by the addition of hydrogen sulphide.

$$\underset{\text{Potassium Sulphide.}}{K_2S_3} + \underset{\text{Cupric Sulphate.}}{CuSO_4} = \underset{\text{Potassium Sulphate.}}{K_2SO_4} + \underset{\text{Cupric Sulphide.}}{CuS} + \underset{\text{Sulphur.}}{S_2}.$$

Uses.—Sulphurated potassa is sometimes given internally, in five-grain doses (0.3 Gm.). It is generally used externally, in skin diseases.

POTASSII ACETAS. *U. S.* Potassium Acetate.

$KC_2H_3O_2$; 97.89.

Preparation.—This salt may be made by adding crystals of potassium bicarbonate to pure acetic acid until effervescence ceases, and, after acidulating slightly with a few drops of the acid, cautiously evaporating to dryness in a porcelain capsule by means of a sand-bath.

Great care is necessary to avoid contamination with iron, and it is not safe to use an enamelled iron dish.

$$\underset{\text{Potassium Bicarbonate.}}{KHCO_3} + \underset{\text{Acetic Acid.}}{HC_2H_3O_2} = \underset{\text{Potassium Acetate.}}{KC_2H_3O_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

The manufacturer nearly always uses the carbonate in making potassium acetate, instead of the bicarbonate, because it is much cheaper. The product from the carbonate is not apt to be pure, however, because of the silica, sulphate, chlorides, etc., always present in the ordinary carbonate.

Potassii Acetas. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white powder, or crystalline masses of a satiny lustre, very deliquescent on exposure to the air. When heated to 292° C. (557.6° F.), the salt fuses. At a higher temperature it decomposes, blackens, and evolves vapors having an empyreumatic odor (an alliaceous odor would indicate the presence of *arsenic*), and finally leaves a white residue of potassium carbonate, which should be completely soluble in water.	Odorless; warming, saline taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 0.36 part. Boiling, Very soluble.	At 15° C. (59° F.), 1.9 parts. Boiling, Very soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On the addition of sodium cobaltic nitrite T.S., a copious yellow precipitate is formed.		Having prepared a solution of 2.5 Gm. of the salt in 50 C.c. of water, use 10 C.c. of it for each of the following tests:
The addition of sodium bitartrate T.S. to the aqueous solution causes a white crystalline precipitate.	Arsenic, Lead, etc.	After a portion has been acidulated with a few drops of hydrochloric acid, the addition of an equal volume of hydrogen sulphide T.S. should produce no precipitate.
When the salt is heated with a small amount of sulphuric acid, vapors of acetic acid are evolved.	Sulphate.	In another portion, acidulated with hydrochloric acid, 1 C.c. of barium chloride T.S. should produce no visible change.
The addition of a little ferric chloride T.S. to a solution of the salt produces a deep red color, and. upon the application of heat, a pale brown. flocculent precipitate of basic ferric acetate separates.	Chloride.	If to a portion of the solution, acidulated with nitric acid, 0.1 C.c. of decinormal silver nitrate V.S. be added, the liquid should, after filtration, show no further change on the addition of more silver nitrate V.S.
	Iron.	Addition of 0.3 C.c. of potassium ferrocyanide T.S. should effect no change in the solution within fifteen minutes.
If 1 Gm. of Potassium Acetate be, by thorough ignition, converted into carbonate, the residue should require, for complete neutralization, not less than 10 C.c. of normal sulphuric acid (corresponding to at least 98 per cent. of pure Potassium Acetate), methyl-orange being used as indicator.	Iron, Aluminum, etc.	No coloration or precipitate should be produced by adding 1 C.c. of ammonium sulphide T.S.
	Carbonate.	Fragments of the salt, sprinkled upon sulphuric acid, should produce no effervescence,
	Readily Carbonizable Organic Impurities.	Nor impart any color.

Uses.—Potassium acetate is a reliable diuretic when given in doses of twenty grains to one drachm (1.2 to 3.7 Gm.). In larger doses it acts as a cathartic.

POTASSII BICARBONAS. *U.S.* Potassium Bicarbonate.

$KHCO_3$; 99.88.

Preparation.—This salt is made by passing carbon dioxide through a solution of potassium carbonate until it is fully saturated, then filtering the liquid, and evaporating at a temperature below 71° C. (160° F.) to prevent decomposition. The crystals formed should be well washed and dried.

$$\underset{\text{Potassium Carbonate.}}{K_2CO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Potassium Bicarbonate.}}{2KHCO_3}.$$

The cheapest way to make this salt is to suspend a dish containing a concentrated solution of potassium carbonate within the fermenting tuns of a brewery: the carbon dioxide produced during fermentation is thus utilized. The crude salt obtained on evaporation is called *Saleratus*. When purified by crystallization, it constitutes the official bicarbonate.

Potassii Bicarbonas. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, monoclinic prisms, permanent in dry air. The dry salt begins to lose carbon dioxide at 100° C. (212° F.), and this loss increases at a higher temperature, until, at a red heat, the salt has lost 30.97 per cent. of its original weight, leaving a residue of carbonate.	Odorless; saline and slightly alkaline taste. The pure salt when dissolved in water is at first neutral to litmus paper and to phenolphtalein T.S., but the solution soon becomes feebly alkaline by partial conversion of the salt into carbonate.	At 15° C. (59° F.), 3.2 parts, and in 1.9 parts at 50° C. (122° F.). At a higher temperature the solution rapidly loses carbon dioxide, and, after being boiled, contains only potassium carbonate. Decomposed by boiling water.	Almost insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Sodium cobaltic nitrite T.S. produces in the aqueous solution a copious yellow precipitate. Tartaric acid T.S., added to the aqueous solution in excess, causes a white crystalline precipitate. To neutralize 1 Gm. of Potassium Bicarbonate should require 10 C.c. of normal sulphuric acid (corresponding to 100 per cent. of the pure salt), methyl-orange being used as indicator.	Limit of Carbonate.	A solution of 0.5 Gm. of Potassium Bicarbonate in 10 C.c. of water should not at once be colored red by one drop of phenolphtalein T.S.
		Dissolve 2.5 Gm. of the salt in 30 C.c. of diluted acetic acid, and, having made up the volume to 50 C.c. with water, use 10 C.c. for each of the following tests:
	Metallic Impurities.	No visible change should occur in a portion of this solution upon the addition of an equal volume of hydrogen sulphide T.S.
	Limit of Iron.	The addition of 0.3 C.c. of potassium ferrocyanide T.S. to another portion should not produce a blue color within fifteen minutes.
	Limit of Chloride.	After adding a few drops of nitric acid and 0.1 C.c. of decinormal silver nitrate V.S. to another portion, and filtering, the further addition of silver nitrate V.S. should not affect the filtrate.

Uses.—This salt is largely used as affording the purest available source of the potassium salts. The large quantity of carbonic acid which it yields on decomposition renders it useful in beverages and

laxative draughts, such as solution of magnesium citrate. It is milder than the carbonate, and when administered internally it is more acceptable to the stomach. The dose is from fifteen to thirty grains (0.9 to 1.8 Gm.).

POTASSII BICHROMAS. *U. S.* Potassium Bichromate.

$K_2Cr_2O_7$; 293.78.

[POTASSIUM DICHROMATE.]

Preparation.—The source of this salt is *chrome iron ore*, which is found in several localities, notably in the neighborhood of Baltimore, Md. The ore is first roasted, then powdered, mixed with potassium carbonate and chalk, and the mixture heated strongly with access of air. The iron and chromium are both oxidized to ferric oxide and chromic acid; the latter attacks the potassium carbonate, and causes an evolution of carbon dioxide by combining with the potassium and forming neutral potassium chromate.

The solution of the latter is treated with an acid, usually sulphuric, but nitric acid would be preferable on some accounts, potassium nitrate being more readily separated from potassium bichromate than potassium sulphate. Sulphuric acid, however, is cheaper.

$$\underset{\text{Chrome Iron Ore.}}{2(FeOCr_2O_3)} + \underset{\text{Potassium Carbonate.}}{4K_2CO_3} + \underset{\text{Oxygen.}}{7O} = \underset{\text{Potassium Chromate.}}{4(K_2CrO_4)} + \underset{\text{Ferric Oxide.}}{Fe_2O_3} + \underset{\text{Carbon Dioxide.}}{4CO_2};$$

then

$$\underset{\text{Potassium Chromate.}}{2(K_2CrO_4)} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Potassium Bichromate.}}{K_2Cr_2O_7} + \underset{\text{Potassium Sulphate.}}{K_2SO_4} + \underset{\text{Water.}}{H_2O}.$$

This salt is sometimes called potassium dichromate, and is considered to be a compound of potassium chromate with chromic anhydride, K_2CrO_4,CrO_3.

Potassii Bichromas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Large, orange-red, transparent, four-sided triclinic prisms, permanent in the air. The salt fuses below a red heat, forming a dark brown liquid, without loss of weight.	Odorless; bitter, metallic taste; acid reaction.	At 15° C. (59° F.), 10 parts. Boiling, 1.5 parts.	Insoluble.

TESTS FOR IDENTITY.

At a white heat it evolves oxygen and leaves a residue of neutral potassium chromate and green chromic oxide.
On mixing 4 C.c. of the aqueous solution with 0.5 C.c. of alcohol, and then with 1 C.c. of sulphuric acid, the liquid will assume a green color and emit the odor of aldehyde.
Sodium cobaltic nitrite T.S. produces in the aqueous solution a copious yellow precipitate.

Uses.—This salt is used in the preparation of chromic and valerianic acids, and for forming an official test-liquid, the value of which as an indicator depends upon its yielding its oxygen to acid liquids (see Test-

Liquids). When given internally, in large doses, it is an irritant poison: the proper dose is one-fifth of a grain (0.013 Gm.): soap, magnesia, or chalk would be a suitable antidote.

POTASSII BITARTRAS. *U. S.* Potassium Bitartrate.

$KHC_4H_4O_6$; 187.67.

[CREAM OF TARTAR.]

Preparation.—This well-known salt is made by purifying *argols*, or *tartar*, a substance deposited in wine-casks during the fermentation of the grape-juice. (See Acid Saccharine Fruits, Part IV.)

Potassii Bitartras. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, permanent in the air. When heated on platinum foil, the salt chars and evolves inflammable vapors having the odor of burnt sugar.	Odorless; pleasant acidulous taste; acid reaction.	At 15° C. (59° F.), 201 parts. Boiling, 16.7 parts.	Very slightly soluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The odor of *ammonia* should not be evolved on heating the salt with a slight excess of potassium or sodium hydrate T.S. If 1.88 Gm. of Potassium Bitartrate be thoroughly ignited at a red heat, it should require for complete neutralization not less than 9.9 C.c. of normal sulphuric acid V.S. (each C.c. corresponding to 10 per cent. of the purer salt), phenolphtalein being used as indicator. When heated strongly, with free access of air, the carbon of the black residue is oxidized, and a white fused mass of potassium carbonate remains, which has an alkaline reaction, and effervesces strongly with acids. With sodium cobaltic nitrite T.S. it yields a copious yellow precipitate. In the aqueous solution of the salt, rendered neutral by potassium or sodium hydrate T.S., silver nitrate T.S. produces a white precipitate which, on boiling, becomes black by the separation of metallic silver. If, before applying heat, enough ammonia water be added to dissolve the white precipitate, upon boiling the solution a mirror will be deposited on the sides of the test-tube.	Chloride.	If 1.5 Gm. of the salt be shaken with 30 C.c. of water and the mixture filtered, 10 C.c. of the filtrate, after being acidulated with nitric acid, should not be rendered turbid by 0.5 C.c. of silver nitrate T.S.,
	Sulphate.	Nor by 0.5 C.c. of barium chloride T.S.
	Insoluble Matter.	A solution of 0.5 Gm. of the salt in 3 C.c. of ammonia water should leave no insoluble residue,
	Copper, Lead, Iron, etc.	Nor be affected by ammonium sulphide.
	Limit of Calcium Salt.	If 1.2 Gm. of Potassium Bitartrate be repeatedly agitated, during half an hour, with a mixture of 5 C.c. of acetic acid and 1 C.c. of water, and the mixture be then diluted with 30 C.c. of water, and filtered, the clear filtrate should not be rendered turbid, within one minute, by the addition of 0.5 C.c. of ammonium oxalate T.S.

Calcium tartrate is always present in grape-juice, and it is permitted by the official test in potassium bitartrate if not in greater proportion than 1 per cent.

Uses.—This salt is the source of tartaric acid and some of the tartrates. It is one of the ingredients in compound powder of jalap, and

is frequently used as a refrigerant and purgative in doses of one to four drachms (3.8 to 15.5 Gm.)

POTASSII BROMIDUM. *U. S.* Potassium Bromide.

KBr; 118.79.

Preparation.—Two methods are used in making this salt. In the one which was formerly official, ferrous bromide, made by acting on iron with bromine, is treated with potassium carbonate; ferrous carbonate precipitates, and potassium bromine remains in solution. The latter is filtered and evaporated, that crystals may form.

$$\underset{\text{Ferrous Bromide.}}{FeBr_2} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Ferrous Carbonate.}}{FeCO_3} + \underset{\text{Potassium Bromide.}}{2KBr.}$$

In the other method, bromine is added to solution of potassa, producing potassium bromide and bromate. The solution is evaporated to dryness, mixed with charcoal, and heated to redness. The bromate is deoxidized and converted into bromide, carbon monoxide escaping.

$$\underset{\text{Potassium Bromate.}}{2KBrO_3} + \underset{\text{Carbon.}}{3C_2} = \underset{\text{Potassium Bromide.}}{2KBr} + \underset{\text{Carbon Monoxide.}}{6CO.}$$

Formerly this salt was imported. It is now made in the United States upon a large scale, and is exported.

Potassii Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless or white, cubical crystals, or granules, permanent in air. On heating the salt upon platinum foil, it decrepitates; near 700° C. (1290° F.) it fuses without decomposition, and at a bright-red heat it volatilizes, communicating a violet color to the flame.	Odorless; pungent, saline taste; neutral or slightly alkaline reaction.	At 15° C. (59° F.), 1.6 parts. Boiling, 1 part.	At 15° C. (59° F.), 200 parts. Boiling, 16 parts.	Soluble in 4 parts of glycerin.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The addition of tartaric acid T.S., or of sodium bitartrate T.S., produces in it, after some time, a white crystalline precipitate. Sodium cobaltic nitrite T.S. produces in it at once a copious yellow precipitate.	Limit of Potassium Carbonate.	If 1 Gm. of the salt be dissolved in 10 C.c. of a mixture of 100 C.c. of water and 0.2 C.c. of normal sulphuric acid, no red tint should be imparted to the solution by the addition of a few drops of phenolphtalein T.S.
	Sodium.	If a little of the salt be held in a non-luminous flame, on a perfectly clean platinum wire, the flame should be colored violet at once, without any appearance of yellow.
	Bromate.	If diluted sulphuric acid be dropped upon crushed crystals of the salt, they should not at once assume a yellow color.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
If to 10 C.c. of the aqueous solution of the salt a few drops of chloroform be added, then 1 C.c. of chlorine water, and the mixture be agitated, the liberated bromine will dissolve in the chloroform, imparting to it a yellow or brownish-yellow color without a violet tint.	Iodine.	If 10 C.c. of the aqueous solution (1 in 20) be mixed with a little starch T.S., the addition of a few drops of chlorine water should not produce a blue color.
	Iron, Aluminum, etc.	Ten C.c. of the aqueous solution (1 in 12) should not be rendered turbid by the addition of 0.5 C.c. of ammonia water and of 0.5 C.c. of ammonium sulphide T.S.
	Arsenic, Lead, Copper, etc.	Nor should 10 C.c., after being slightly acidulated with acetic acid, be rendered turbid by an equal volume of hydrogen sulphide T.S.,
	Calcium.	Nor by 0.5 C.c. of ammonium oxalate T. S.,
	Barium.	Nor by 0.5 C.c. of potassium sulphate T.S.,
	Sulphate.	Nor by 0.5 C.c. of barium chloride T.S.,
	Iron.	Nor be colored blue by 0.5 C.c. of potassium ferrocyanide T.S.
	More than 2 per cent. of Chloride.	If 0.5 Gm. of the well-dried salt be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should not require more than 42.85 C.c. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate.

The official test to indicate the presence of more than 2 per cent. of chloride depends upon the formation of red argentic chromate, which does not take place until after all the chlorine has entered into combination with the silver.

Uses.—Potassium bromide is largely used as a nervine, in doses of twenty grains (1.2 Gm.), frequently repeated.

POTASSII CARBONAS. *U. S.* Potassium Carbonate.

K_2CO_3; 137.91.

Preparation.—This salt, known commercially as *Sal Tartar*, is made by dissolving pearlash, or impure potassium carbonate, in an equal weight of *cold water*, allowing the mixture to stand a day or two, filtering the solution, pouring it into a bright iron dish, and evaporating over a gentle fire until it thickens, then removing it from the fire and stirring constantly with an iron spatula, so as to form a granular salt (see page 249).

A purer carbonate is produced by decomposing potassium bicarbonate by heating to redness, thus driving off water of crystallization and a portion of the carbon dioxide.

$$\underset{\text{Potassium Bicarbonate.}}{2KHCO_3} = \underset{\text{Potassium Carbonate.}}{K_2CO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

Potassii Carbonas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white, granular powder, very deliquescent. When heated to 130° C. (266° F.), the salt loses all its water. At a bright red heat it melts, and at a white heat it volatilizes, communicating to the flame a pure violet color. The aqueous solution strongly effervesces on the addition of acids, and with an excess of tartaric acid produces a white, crystalline precipitate, and with sodium cobaltic nitrite T.S. a copious yellow precipitate is formed at once.	Odorless; strongly alkaline taste; alkaline reaction.	At 15° C. (59° F.), 1.1 parts. Boiling, 0.65 part.	Insoluble.

Quantitative Test.	Impurities.	Tests for Impurities.
To neutralize 0.69 Gm. of Potassium Carbonate should require not less than 9.5 C.c. of normal sulphuric acid (each C.c. corresponding to 10 per cent. of the pure salt), methyl-orange being used as indicator.	Sodium.	When a small portion of the salt, treated with a drop of hydrochloric acid, is introduced into a non-luminous flame on a perfectly clean platinum wire, the flame should be colored violet at once, without any appearance of yellow.
	Earthy Impurities.	No residue should be left on dissolving 1 Gm. of the salt in 20 C.c. of water.
	Metallic Impurities.	No precipitate or coloration should be produced in the aqueous solution (1 in 20) by an equal volume of hydrogen sulphide T.S.
	Hyposulphite.	On neutralizing the solution with hydrochloric acid, no odor of burning sulphur, nor any white precipitate, should appear.
	Nitrate.	If 2 C.c. of the aqueous solution (1 in 20) be carefully mixed with an equal volume of concentrated sulphuric acid, and, after cooling, 1 C.c. of ferrous sulphate T.S. be poured upon it so as to form a separate layer, no brown color should appear at the line of contact.
	Sulphate.	If 0.5 Gm. of Potassium Carbonate be dissolved in 5 C.c. of diluted hydrochloric acid and 5 C.c. of water, the addition of 1 C.c. of barium chloride T.S. should not produce any turbidity.
	Iron.	A solution of 0.5 Gm. of the salt in 5 C.c. of diluted hydrochloric acid mixed with 5 C.c. of water should not be colored blue within fifteen minutes by 0.3 C.c. of potassium ferrocyanide T.S.
	Chloride.	If 0.5 Gm. of the salt be dissolved in 6 C.c. of diluted nitric acid and 4 C.c. of water, then 0.1 C.c. of decinormal silver nitrate V.S. be added, and the mixture filtered, no change should be produced in the filtrate by the further addition of silver nitrate V.S.
	Cyanide.	If 10 C.c. of the aqueous solution (1 in 20) be mixed with 2 drops, each, of ferrous sulphate T.S. and ferric chloride T.S., the mixture heated, and slightly supersaturated with hydrochloric acid, no blue color should appear.
	Sulphide.	The addition of a few drops of lead acetate T.S. to the aqueous solution should produce a pure white precipitate.

Uses.—Potassium carbonate is an antacid, but it is less agreeable than the bicarbonate. The dose is fifteen grains (0.9 Gm.), largely diluted. In large doses it is an irritant caustic, the proper antidotes to administer being diluted vinegar, lemon-juice, or weak acids.

POTASSII CHLORAS. *U. S.* Potassium Chlorate.

$KClO_3$; 122.28.

Preparation.—Chlorate of potash, as it is always termed commercially, was formerly made by passing chlorine gas into a solution of potassa. This is a very wasteful process, as only one-fifth of the potassa is obtained as chlorate, the rest passing into potassium chloride. It is now more economically prepared by boiling together solutions of potassium chloride and calcium hypochlorite, whereby potassium chlorate and calcium chloride are produced.

When a solution of calcium hypochlorite is boiled, it is decomposed, and calcium chlorate and calcium chloride are formed:

$$\underset{\text{Calcium Hypochlorite.}}{3Ca(OCl)_2} = \underset{\text{Calcium Chloride.}}{2CaCl_2} + \underset{\text{Calcium Chlorate.}}{Ca(O_3Cl)_2}.$$

When solution of calcium chlorate is heated in contact with potassium chloride, double decomposition takes place, as shown by the following equation:

$$\underset{\text{Calcium Chlorate.}}{Ca(O_3Cl)_2} + \underset{\text{Potassium Chloride.}}{2KCl} = \underset{\text{Potassium Chlorate.}}{2KClO_3} + \underset{\text{Calcium Chloride.}}{CaCl_2}.$$

The potassium chlorate is easily separated from the calcium chloride, because it is much less soluble than the latter.

Potassii Chloras. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, lustrous, monoclinic prisms or plates, or a white powder, permanent in the air. At 234° C. (453.2° F.) the salt fuses, and above 352° C. (665.6° F.) it is decomposed into oxygen and potassium perchlorate; above 400° C. (752° F.) all its oxygen is liberated, and a white residue of potassium chloride remains, amounting to 60.8 per cent. of the chlorate employed. This residue is readily soluble in water, and the solution yields a white, curdy precipitate with silver nitrate T.S.	Odorless; cooling saline taste; neutral reaction.	At 15° C. (59° F.), 16.7 parts. Boiling, 1.7 parts.	Insoluble in absolute alcohol. Slightly soluble in mixtures of alcohol and water.

Tests for Identity.	Impurities.	Tests for Impurities.
With excess of tartaric acid T.S. the solution slowly yields a scant, white, crystalline precipitate; with sodium cobaltic nitrite T.S., or with platinic chloride T.S., a copious yellow precipitate is produced at once.	Sodium.	When introduced into a non-luminous flame on a clean platinum wire, Potassium Chlorate communicates to the flame a pure violet color, without admixture of yellow.
When heated with hydrochloric acid, the aqueous solution assumes a greenish-yellow color, and evolves chlorine.	Sulphate.	Separate portions, each of 5 C.c., of the aqueous solution (1 in 20) should not be rendered turbid by 0.5 C.c. of barium chloride T.S.,
	Calcium.	Nor by 0.5 C.c. of ammonium oxalate T.S.,
	Chloride.	Nor by 0.5 C.c. of silver nitrate T.S.
	Metals.	Nor should an equal volume of hydrogen sulphide T.S. produce either a precipitate or a coloration.
	Nitrate or Nitrite.	If a mixture of 1 Gm. of the salt with 0.5 Gm., each, of iron and of zinc, in coarse powder or filings, be heated with 5 C.c. of potassium hydrate T.S., no evolution of *ammonia* should be perceptible either by moistened red litmus paper or by odor.

Potassium chlorate should not be triturated with readily oxidizable or combustible substances, if explosions are to be avoided.

Uses.—Potassium chlorate is used chemically as a source for obtaining oxygen, and medicinally is largely employed in diphtheria, sore throat, scarlet fever, etc., in doses of ten to twenty grains (0.6 to 1.2 Gm.).

POTASSII CITRAS. *U. S.* Potassium Citrate.

$K_3C_6H_5O_7 + H_2O$; 323.59.

Preparation.—This salt is made by adding potassium bicarbonate to a solution of citric acid until effervescence ceases, filtering the solution, evaporating to dryness, and granulating (see page 249).

$$\underset{\text{Potassium Bicarbonate.}}{3KHCO_3} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\text{Potassium Citrate.}}{K_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

Manufacturers generally use the carbonate as the source of the potassium, as it is much cheaper than the bicarbonate. When carelessly made from the carbonate, silica may be present, which is to be suspected if the potassium citrate is not entirely soluble in water.

Potassii Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Transparent, prismatic crystals, or a white, granular powder, deliquescent on exposure to air. When heated above 100° C. (212° F.), the salt begins to lose water; at 200° C. (392° F.) the water of crystallization (5.55 per cent.) is completely lost; at 230° C. (446° F.) the salt begins to decompose, turns brown, and at a higher temperature carbonizes, and emits inflammable gases which have a very pungent, acid odor. At a red heat a blackened mass of potassium carbonate and carbon is left, which has an alkaline reaction, and strongly effervesces with acids.	Odorless; slightly cooling, saline taste; neutral reaction.	At 15° C. (59° F.), 0.6 part. Boiling, Very soluble.	Very slightly soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The salt yields a white, crystalline precipitate with sodium bitartrate T.S.	Carbonate.	The aqueous solution (1 in 20) should not be colored red by a drop of phenolphtalein T.S., nor effervesce on the addition of an acid.
On mixing 10 C.c. of the aqueous solution (1 in 20) with 2.5 C.c. of calcium chloride T.S., the liquid remains clear until it is boiled, when a white, granular precipitate is produced.	Sulphate and Chloride.	Separate portions of this solution acidulated with nitric acid should not be affected by barium chloride T.S., nor by silver nitrate T.S.
If 1.08 (1.079) Gm. of Potassium Citrate be thoroughly ignited at a red heat, it should require for complete neutralization not less than 10 C.c. of normal sulphuric acid (corresponding to 100 per cent. of the pure salt), methyl-orange being used as indicator.	Tartrate.	A solution of 1 Gm. of Potassium Citrate in 1 C.c. of water should not deposit any precipitate on the addition of 1 C.c. of acetic acid.

Uses.—Potassium citrate is principally employed in medicine as a diaphoretic, in doses of twenty grains (1.2 Gm.). It is found in the official solution of potassium citrate.

POTASSII CITRAS EFFERVESCENS. *U. S.* **Effervescent Potassium Citrate.**

	Metric.	Old form.
Citric Acid	63 Gm.	126 grains.
Potassium Bicarbonate	90 Gm.	180 grains.
Sugar	47 Gm.	94 grains.

Powder the ingredients separately, and mix them thoroughly in a warm mortar. Dry the resulting, uniform paste rapidly at a temperature not exceeding 120° C. (248° F.), and, when it is perfectly dry, reduce it to a powder of the desired degree of fineness. Keep the product in well-stoppered bottles.

Uses.—This forms an agreeable diaphoretic given in cold water in doses of thirty to sixty grains (1.9 to 3.8 Gm.).

LIQUOR POTASSII CITRATIS. *U. S.* Solution of Potassium Citrate.

[MISTURA POTASSII CITRATIS.]

An aqueous liquid, containing in solution about 9 per cent. of anhydrous Potassium Citrate [$K_3C_6H_5O_7 = 305.63$], together with small amounts of citric and carbonic acids.

	Metric.	Old form.
Potassium Bicarbonate	8 Gm.	480 grains.
Citric Acid	6 Gm.	360 grains.
Water, a sufficient quantity.		

Dissolve the Potassium Bicarbonate and the Citric Acid, each, in 40 C.c. [old form 5½ fl. oz.] of Water. Filter the solutions separately, and wash the filters with enough Water to obtain, in each case, 50 C.c. [old form 6½ fl. oz.]. Finally, mix the two solutions, and, when effervescence has nearly ceased, transfer the liquid to a bottle.

For this preparation it will be found convenient in dispensing practice to keep the separate solutions of Citric Acid and Potassium Bicarbonate on hand ready to be mixed when the solution of potassium citrate is needed. The solutions keep moderately well. It is officially described as a clear, colorless liquid, odorless, having a mildly saline taste and a slightly acid reaction. The solution contains about 9 per cent. of potassium citrate, with some free Citric Acid and carbonic acid gas. It responds to the reactions and tests of potassium citrate (see Potassii Citras).

Neutral Mixture is a more agreeable preparation than this solution. It is made by nearly saturating lemon-juice with Potassium Bicarbonate. It was official in the U. S. P. 1880 under the name of *Mistura Potassii Citratis.*

Uses.—Solution of potassium citrate is refrigerant and diaphoretic, in doses of 1 fluidrachm (3.7 C.c.).

POTASSII CYANIDUM. *U. S.* Potassium Cyanide.

KCN ; 65.01.

Preparation.—A process for making this salt was formerly official. It is as follows: Take of Ferrocyanide of Potassium, dried, 8 *troyounces;* Pure Carbonate of Potassium, dried, 3 *troyounces.* Mix the salts intimately, and throw the mixture into a deep iron crucible previously heated to redness. Maintain the temperature until effervescence ceases, and the fused mass concretes, of a pure white color, upon a warm glass rod dipped into it. Then pour out the liquid carefully into a shallow dish to solidify, ceasing to pour before the salt becomes contaminated with the precipitated iron. Break up the mass while yet warm, and keep the pieces in a well-stopped bottle.

The reaction between the potassium ferrocyanide and the potassium carbonate results in the production of potassium cyanide, potassium cyanate, iron, and carbon dioxide. The iron is precipitated out in the form of a fine powder, carbon dioxide escapes, and potassium cyanide, with a small proportion of cyanate, is produced.

$$\underset{\text{Potassium Ferrocyanide.}}{K_4Fe(CN)_6} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Potassium Cyanide.}}{5KCN} + \underset{\text{Potassium Cyanate.}}{KOCN} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Iron.}}{Fe.}$$

Potassium cyanide is found in commerce of several qualities. The cheapest grade is used for mining and metallurgical processes and in the arts. A granulated salt is used medicinally. It is sometimes cast into sticks, and in this form, of German manufacture, is of good quality. Chemically pure crystallized potassium cyanide is also in the market.

Potassii Cyanidum, *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
White, opaque, amorphous pieces, or a white, granular powder, deliquescent in damp air. When heated to a low red heat, the salt fuses.	Odorless when perfectly dry, but in moist air exhaling the odor of hydrocyanic acid; taste sharp, somewhat alkaline, but should be ascertained with great care, as *the salt is very poisonous;* strongly alkaline reaction, emitting odor of hydrocyanic acid.	At 15° C. (59° F.), 2 parts. Boiling, 1 part, with decomposition.	Sparingly soluble.

Tests for Identity.	Impurities.	Tests for Impurities.
Its aqueous solution yields a white, crystalline precipitate on the addition of an equal volume of sodium bitartrate. With sodium cobaltic nitrite T.S. a copious yellow precipitate is produced.	Limit of Carbonate.	The aqueous solution (1 in 20) should not produce more than a slight effervescence on the addition of diluted hydrochloric acid.
A few drops of the solution give with silver nitrate T.S. a white precipitate, which is soluble in an excess of the solution of potassium cyanide, also in ammonia water, and in concentrated nitric acid (distinction from silver chloride).		
If 5 C.c. of the solution be shaken with a few drops of ferrous sulphate T.S., and a slight excess of hydrochloric acid then added, a blue precipitate (Prussian blue) will be produced.	Ferrocyanide.	After the acid has been added in slight excess, a drop of ferric chloride T.S. should not produce a blue color,
A solution of 0.65 Gm. of Potassium Cyanide in 12 C.c. of water should require the addition of at least 45 C.c. of decinormal silver nitrate V.S. before the precipitate, which at first redissolves on agitation, becomes permanent (each C.c. of the volumetric solution indicating 2 per cent. of the pure salt).	Sulphocyanate.	Nor a red color.

Uses.—The action of this salt upon animals as a *poison* is the same as that of hydrocyanic acid. The dose is *one-eighth of a grain* (0.008 Gm.). It is more stable than the acid, and is frequently used as a substitute for it.

POTASSII ET SODII TARTRAS. *U.S.* Potassium and Sodium Tartrate.

$KNaC_4H_4O_6 + 4H_2O = 281.51.$ [Rochelle Salt.]

Preparation.—This salt is made by adding potassium bitartrate to a solution of sodium carbonate: the proportions are shown by the former official process, which is as follows:

Take of Carbonate of Sodium, 12 *troyounces;* Bitartrate of Potassium, in fine powder, 16 *troyounces;* Boiling Water, 5 *pints.* Dissolve the Carbonate of Sodium in the Water, and gradually add the Bitartrate of Potassium. Filter the solution, and evaporate until a pellicle begins to form; then set it aside to crystallize. Pour off the mother-water,

and dry the crystals on bibulous paper. Lastly, evaporate the mother-water, that it may furnish more crystals.

It is advantageous to filter the solution after one-half of its volume has been evaporated and it has cooled and settled, in order to free it from the calcium tartrate which separates, otherwise the crystals will be contaminated.

The following equation shows the reaction:

$$\underset{\text{Potassium Bitartrate.}}{2KHC_4H_4O_6} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Potassium and Sodium Tartrate.}}{2KNaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}$$

The chemical constitution of the tartrates will be fully explained under Acidum Tartaricum, but this opportunity will be embraced to note that tartaric acid is a dibasic acid; in its acid salts the hydrogen can be replaced by a base, which in this case is sodium.

Potassii et Sodii Tartras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, rhombic prisms, or a white powder, slightly efflorescent in dry air. When heated to 74° C. (165.2° F.), the salt fuses to a colorless liquid, which, at a higher temperature, froths, becomes brown, and gradually carbonizes, while inflammable vapors are emitted, having the odor of burning sugar. Finally a black residue is left, consisting of alkaline carbonate mixed with carbon.	Odorless; cooling, saline taste; neutral reaction.	At 15° C. (59° F.), 1.4 parts. Boiling, Less than 1 part.	Almost insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
A 10-per-cent. aqueous solution of the salt yields a white, crystalline precipitate on the addition of an equal volume of acetic acid. With silver nitrate T.S. it yields a white precipitate, which becomes black on boiling. With sodium cobaltic nitrite T.S. the solution yields a copious yellow precipitate. To a non-luminous flame it communicates a yellow color (*sodium*), which, when viewed through a blue glass, appears violet-red (*potassium*). When heated with potassium hydrate T.S., the solution should not give off the odor of *ammonia*. If 1.41 Gm. of Potassium and Sodium Tartrate be completely decomposed by ignition, the alkaline residue should require for complete neutralization not less than 10 C.c. of normal sulphuric acid (corresponding to 100 per cent. of the pure salt), methyl-orange being used as indicator.	Calcium. Arsenic, Lead, Copper, etc. Sulphate. Limit of Chloride.	The aqueous solution (1 in 20) should not be rendered turbid by the addition of a small amount of ammonium oxalate T.S., Nor by an equal volume of hydrogen sulphide T.S. either before or after acidulation with diluted hydrochloric acid. If 10 C.c. of the solution (1 in 20) be mixed with 1 C.c. of hydrochloric acid, the addition of 1 C.c. of barium chloride T.S. should produce no turbidity. If 0.36 Gm. of the salt be dissolved in 9 C.c. of water, then 1 C.c. of nitric acid and 0.2 C.c. of decinormal silver nitrate V.S. be added, and the mixture filtered, the filtrate should remain clear upon the further addition of silver nitrate V.S.

Uses.—Rochelle salt, as it is habitually termed, is an efficient purgative in the dose of half an ounce to an ounce (15.5 to 31.1 Gm.). It is an important ingredient in the well-known Seidlitz powders.

POTASSII FERROCYANIDUM. *U. S.* **Potassium Ferrocyanide.**

$K_4Fe(CN)_6 + 3H_2O$; 421.76.

[YELLOW PRUSSIATE OF POTASH.]

Preparation.—When refuse animal substances which contain nitrogen are heated in an iron pot with crude pearlash, impure potassium cyanide is formed. If the fused mass is lixiviated and treated with freshly-precipitated ferrous carbonate, potassium ferrocyanide is produced, according to the following reaction:

$$\underset{\text{Potassium Cyanide.}}{6KCN} + \underset{\text{Ferrous Carbonate.}}{FeCO_3} = \underset{\text{Potassium Ferrocyanide.}}{K_4Fe(CN)_6} + \underset{\text{Potassium Carbonate.}}{K_2CO_3}.$$

This salt is important, because it is the source of all the cyanogen compounds used in medicine.

Potassii Ferrocyanidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Large, soft, transparent, yellow, four-sided monoclinic tables, slightly efflorescent in dry air. When heated to 60° C. (140° F.), the salt becomes white from loss of water, and when 100° C. (212° F.) is reached, it becomes anhydrous.	Odorless; mild, saline taste; neutral reaction.	At 15° C. (59° F.), 4 parts. Boiling, 2 parts.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution yields a white, crystalline precipitate on the addition of sodium bitartrate T.S., a dark blue precipitate with ferric chloride T.S., a reddish-brown precipitate with copper sulphate T.S., and a white one with lead acetate T.S., or silver nitrate T.S. Sodium cobaltic nitrite T.S. produces a copious yellow precipitate.	Carbonate.	No effervescence should be caused by the addition of diluted sulphuric acid to a concentrated solution of the salt.
	Limit of Sulphate.	The aqueous solution (1 in 20), acidulated with hydrochloric acid, should, upon the addition of barium chloride T.S., remain clear, or, at most, show but a trifling turbidity.
	Limit of Chloride.	If a mixture of 0.5 Gm. of the salt with 1.5 Gm. of pure potassium nitrate and 0.5 Gm. of pure, anhydrous sodium carbonate be heated to redness in a porcelain crucible, the residue dissolved in water, the filtered solution supersaturated with nitric acid, mixed with 0.1 C.c. of decinormal silver nitrate V.S., and again filtered, no turbidity should be produced in the filtrate by the further addition of silver nitrate V.S.
	Absence of Ferricyanide.	The precipitate produced in the aqueous solution, acidulated with nitric acid by silver nitrate T.S., should be of a pure white color, without a tinge of red.

Uses.—This salt is rarely employed medicinally: it is *not poisonous* if pure. Chemically, it is important as furnishing a reliable test for ferric salts.

POTASSII HYPOPHOSPHIS. *U. S.* **Potassium Hypophosphite.**

$KH_2PO_2 = 103.91$.

Preparation.—When solutions of calcium hypophosphite and potassium carbonate are mixed, potassium hypophosphite and calcium carbonate are produced by double decomposition, thus:

$$\underset{\text{Calcium Hypophosphite.}}{Ca2H_2PO_2} + \underset{\text{Potassium Carbonate.}}{K_2CO_3} = \underset{\text{Potassium Hypophosphite.}}{2KH_2PO_2} + \underset{\text{Calcium Carbonate.}}{CaCO_3}.$$

The calcium carbonate is removed by filtration, and the clear solution is evaporated till a pellicle forms, after which it is constantly stirred, with continuance of the heat, until the salt granulates. The heat employed in the evaporation should be kept considerably below 100° C. (212° F.), for fear of explosion. If the salt is required quite pure, it should be dissolved in the granulated state, in official alcohol, and the solution evaporated to a syrupy consistence, and then set aside to crystallize.

Potassii Hypophosphis. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
White, opaque, hexagonal plates, or crystalline masses, or a granular powder, very deliquescent. When heated in a dry test-tube, the salt first loses moisture, and then evolves spontaneously inflammable hydrogen phosphide gas, which burns with a bright yellow flame. On triturating or heating the salt with nitrates, chlorates, or other oxidizing agents, it detonates violently.	Odorless; pungent, saline taste; neutral reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.3 part.	At 15° C. (59° F.), 7.3 parts. Boiling, 3.6 parts.	Insoluble in ether.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution (1 in 20) yields a white, crystalline precipitate with sodium bitartrate T.S. With silver nitrate T.S. it yields a white precipitate which rapidly turns brown and black, separating metallic silver. Acidulated with hydrochloric acid and added to excess of mercuric chloride T.S., it first produces a white precipitate of mercurous chloride, and, on further addition, causes the separation of metallic mercury. If 0.1 Gm. of dry potassium hypophosphite be dissolved in 10 C.c. of water, then mixed with 7.5 C.c. of sulphuric acid and 40 C.c. of decinormal potassium permanganate V.S., and the mixture be boiled for fifteen minutes, it should not require more than 2 C.c. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 98.7 per cent. of the pure salt).	Carbonate.	The aqueous solution of the salt should not effervesce on the addition of an acid.
	Calcium.	The aqueous solution of the salt should not be precipitated or rendered cloudy by ammonium oxalate T.S.
	Chloride.	Separate portions of 5 C.c. of the aqueous solution (1 in 20), heated with 1 C.c. of nitric acid, should remain clear upon the addition of silver nitrate T.S.
	Sulphate.	Or of barium chloride T.S.
	Limit of Phosphate.	On mixing the aqueous solution of the salt with a magnesia mixture, not more than a slight cloudiness should make its appearance.

Uses.—The only official use made of potassium hypophosphite is to form one of the ingredients of the largely-used syrup of the hypophosphites. It may be given internally in the dose of fifteen grains (0.9 Gm.).

POTASSII IODIDUM. *U.S.* Potassium Iodide.

KI ; 165.56.

Preparation.—An aqueous solution of potassa is treated with iodine in slight excess. The result is the formation of two salts, iodide and iodate of potassium.

$$\underset{\text{Potassium Hydrate.}}{6KOH} + \underset{\text{Iodine.}}{(I_2)_3} = \underset{\text{Potassium Iodide.}}{5KI} + \underset{\text{Potassium Iodate.}}{KIO_3} + \underset{\text{Water.}}{3H_2O}.$$

By evaporating the solution to dryness the mixed salts are obtained; and if the dry mass be exposed to a red heat, the iodate will be converted into potassium iodide, thus removing this impurity from the iodide.

The mixed salts, towards the close of their evaporation to dryness, should be mixed with powdered charcoal, which facilitates the deoxidation of the iodate. This being accomplished by a dull red heat, the iodide of potassium is dissolved out of the mass, and the solution is set aside to crystallize.

Potassium iodide is always crystallized from an alkaline solution if the manufacturer expects to avoid loss through the discoloration of the product from the separation of free iodine. The official test permits the presence of a small excess of alkali.

Potassii Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless, transparent or translucent, cubical crystals, permanent in dry air, but slightly deliquescent in moist air (the white, opaque, commercial variety being crystallized from an alkaline solution, and less pure), or a whiter granular powder. When heated, the salt decrepitates. At a low red heat it fuses, and at a bright red heat it is slowly volatilized without decomposition.	Peculiar, faint, iodine-like odor; pungent, saline, afterwards bitter taste; neutral or scarcely perceptible alkaline reaction.	At 15° C. (59° F.), 0.75 part. Boiling, 0.5 part.	At 15° C. (59° F.), 18 parts. Boiling, 6 parts.	Soluble in 2.5 parts of glycerin.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The salt yields a white, crystalline precipitate on the addition of sodium bitartrate T.S. If to 5 C.c. of the aqueous solution (1 in 20) of the salt 1 C.c. of chlorine water be added, iodine will be liberated, and impart to the solution a yellow color. On agitating the mixture with a few drops of chloroform, this will acquire a violet color. If 0.5 Gm. of the well-dried salt be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should require not more than 30.25 C.c. nor less than 30 C.c. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate (corresponding to at least 99.5 per cent. of the pure salt).	Less Soluble Salts.	No residue should be left when 1 Gm. of the salt is dissolved in 2 C.c. of diluted alcohol of specific gravity 0.928.
	Limit of Alkali.	If 1 Gm. of the salt be dissolved in water and 0.05 C.c. (one drop) of decinormal oxalic acid V.S. be added, no color should be produced by the subsequent addition of a drop of phenolphtalein T.S., even after heating.
	Sodium.	When a fragment of the salt is brought into a non-luminous flame on a clean platinum wire, a violet color should appear at once.
	Iodate.	If to a solution of the salt (1 in 20) in distilled water, from which all gases have been expelled by boiling, a little starch T.S. be added, and then a few drops of pure diluted sulphuric acid T.S., no blue color should appear at once.
	Arsenic, Lead, Copper, etc.	The aqueous solution (1 in 20) should not be colored or precipitated by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid.
	Sulphate.	The aqueous solution should remain clear after the addition of barium chloride T. S.
	Nitrate or Nitrite.	If 1 Gm. of the salt be mixed with 0.5 Gm. each of iron and of zinc, in coarse powder or filings, and heated in a test-tube with 5 C.c. of sodium hydrate T.S., no ammoniacal vapor should be evolved.
	Iron.	No blue color should be communicated to 5 C.c. of the aqueous solution (1 in 20) by 0.1 C.c. (2 drops) of potassium ferrocyanide T.S.
	Cyanide.	If 5 C.c. of the aqueous solution be gently heated with 1 drop of ferrous sulphate T.S. and 0.5 C.c. of potassium hydrate T.S., no blue color should appear after acidulating the mixture with hydrochloric acid.

Uses.—This is the most valuable medicinal compound of iodine, if the extent to which it is employed is a criterion. It is used as an alterative in five-grain doses (0.3 Gm.); as an antisyphilitic, four drachms (15.5 Gm.), largely diluted, may be given.

POTASSII NITRAS. *U. S.* Potassium Nitrate.

$KNO_3 = 100.92.$ [SALTPETRE.]

Preparation.—*Nitre*, or *Saltpetre*, is sometimes a natural product; usually, however, it is produced artificially in what are known as nitre-beds, which are made up of earth and wood-ashes, with animal and vegetable refuse: these are protected from rain by sheds. In time the ammonia, produced by the decomposition of the organic matter in the mixture, is oxidized, nitric acid is formed, which unites with the potassa in the wood-ashes, and potassium nitrate is gradually formed: this is separated by lixiviation, filtration, evaporation, and crystallization. It is generally imported from Europe or India in a crude state and refined in this country.

Potassii Nitras. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, transparent, six-sided, rhombic prisms, or a crystalline powder, permanent in the air. When heated to 353° C. (667.4° F.), the salt melts; at a higher temperature it is decomposed, giving off oxygen at first, and then some of its nitrogen, and leaving a residue of potassium nitrate, nitrite, and oxide. Thrown upon red-hot coals, the salt deflagrates.	Odorless; cooling, saline, and pungent taste; neutral reaction.	At 15° C. (59° F.), 3.8 parts. Boiling, 0.4 part.	Sparingly soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution (1 in 20) yields a white, crystalline precipitate on the addition of sodium bitartrate T.S.; with sodium cobaltic nitrite T.S. a yellow precipitate.	Iron.	The aqueous solution (1 in 20) should remain unaffected by the addition of a few drops of potassium ferrocyanide T.S.,
	Sulphate.	Or of barium chloride T.S.,
	Chloride.	Or of silver nitrate T.S.,
If a small crystal of ferrous sulphate be dissolved in the aqueous solution (1 in 20), and then concentrated sulphuric acid be poured in so as to form a separate layer, a dark brown color will appear at the line of contact.	Calcium, Zinc, etc.	Or of ammonium carbonate T.S., ammonium oxalate T.S., or ammonium sulphide T.S.,
	Arsenic, Lead, Copper, etc.	Or by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid.
If a drop of diphenylamine T.S. be mixed with the aqueous solution and concentrated sulphuric acid be poured in, as in the preceding test, a deep blue color will appear at the line of contact.	Iodine.	If to 5 C.c. of the aqueous solution of the salt 1 C.c. of chlorine water and a few drops of starch T.S. be added, no blue color should appear.
	Chlorate.	No yellow color should appear when 1 C.c. of pure concentrated sulphuric acid is added to 0.1 Gm. of the dry salt.

Uses.—Potassium nitrate is diuretic and diaphoretic in doses of ten to twenty grains (0.6 to 1.2 Gm.). In concentrated solution it is antiseptic. It is most largely used in making gunpowder.

POTASSII PERMANGANAS. *U.S.* Potassium Permanganate.

$K_2MnO_4 = 157.67.$

Preparation.—This salt may be prepared by the British process, which is as follows:

Take of Caustic Potash 5 oz. av.; Black Oxide of Manganese, in fine powder, 4 oz. av.; Chlorate of Potash 3½ oz. av.; Diluted Sulphuric Acid a sufficiency; Distilled Water 2½ pints (Imp. measure). Reduce the Chlorate of Potash to fine powder, and mix it with the Oxide of Manganese; put the mixture into a porcelain basin, and add to it the Caustic Potash, previously dissolved in 4 fl. oz. of the Water. Evaporate to dryness on a sand-bath, stirring diligently to prevent spurting. Pulverize the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semi-fused mass. Let it cool, pulverize it, and boil with 1½ pints of the Water. Let the insoluble matter subside, decant the fluid, boil again with ½ pint of the Water, again decant, neutralize the united liquors accurately with the Diluted Sulphuric Acid, and evaporate till a pellicle forms. Set aside to cool and crystallize. Drain the crystalline mass, boil it in 6 fl. oz. of the Water and strain through a funnel, the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallize, drain the crystals, and dry them by placing them under a bell-jar over a vessel containing sulphuric acid.

By this process potassium chlorate yields oxygen to manganese dioxide, converting it into manganic acid, which unites with the potassa to form the manganate, potassium chloride being formed at the same time.

$$\underset{\text{Manganese Dioxide.}}{3MnO_2} + \underset{\text{Potassium Hydrate.}}{6KHO} + \underset{\text{Potassium Chlorate.}}{KClO_3} = \underset{\text{Potassium Manganate.}}{3K_2MnO_4} + \underset{\text{Potassium Chloride.}}{KCl} + \underset{\text{Water.}}{3H_2O}.$$

When this solution is boiled with water, the potassium manganate is converted into potassium permanganate, according to the following reaction:

$$\underset{\text{Potassium Manganate.}}{3K_2MnO_4} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Potassium Permanganate.}}{K_2Mn_2O_8} + \underset{\text{Manganese Peroxide.}}{MnO_3H_2} + \underset{\text{Potassium Hydrate.}}{4KHO}.$$

The potassium hydrate liberated by the reaction requires neutralization with an acid if all the permanganate is to be obtained, because the latter, in the presence of an excess of potassa, remains in the condition of manganate.

Potassii Permanganas. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Slender, monoclinic prisms, of a dark purple color, almost opaque by transmitted and of a blue metallic lustre by reflected light. Permanent in the air. When heated, the salt decrepitates, and at 240° C. (464° F.) it decomposes, yielding oxygen, potassium manganate, and manganese dioxide.	Odorless; sweet, afterwards disagreeable, astringent taste; neutral reaction.	At 15° C. (59° F.), 16 parts. Boiling, 3 parts.	Cold, Decomposed. Boiling, Decomposed.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution of the salt is of a deep violet-red color when concentrated, and of a rose color when much diluted, and this color is discharged by hydrogen sulphide, ferrous sulphate, oxalic acid, alcohol, and many other readily oxidizable substances, especially if the solution be first rendered acid by sulphuric acid.		If 0.5 Gm. of the salt be boiled with 10 C.c. of ammonia water and 10 C.c. of water (or with 20 C.c. of water and 4 C.c. of alcohol) until it is completely decomposed, and the liquid then filtered, the clear, colorless filtrate will serve for the following tests:
	Limit of Sulphate.	If to 5 C.c. of the filtrate, acidulated with nitric acid, barium chloride T.S. be added, not more than very slight turbidity should be produced.
If 0.1 Gm. of the salt be dissolved in 10 C.c. of boiling distilled water, and 1 C.c. of sulphuric acid be cautiously added, the solution should require for complete decoloration not less than 31.3 C.c. of decinormal oxalic acid V.S. (corresponding to at least 98.7 per cent. of the pure salt).	Chloride.	If to another portion of 5 C.c., acidulated with nitric acid, silver nitrate T.S. be added, it should produce no precipitate or cloudiness.
	Nitrate or Chlorate.	If to another portion of 5 C.c. of the filtrate 1 drop of diphenylamine T.S. be added, and then 1 C.c. of pure concentrated sulphuric acid be poured in, so as to form a layer beneath, no blue color should appear at the line of contact.

Uses.—Potassium permanganate is one of the most powerful oxidizing agents known, and it is for this reason that the cautionary note is properly appended, "It should not be triturated nor combined in solution with organic or readily oxidizable substances." It is owing to the facility with which it parts with oxygen, when in contact with organic matter, that it is useful as a disinfectant: hence when used externally its application by means of lint, towels, etc., should be avoided, because its energy would be spent upon these instead of upon the part of the body intended to be affected by it. Chemically, it is used as a volumetric test and oxidizer, for which it is admirably adapted on account of the distinctness of its color reactions, although the difficulty of keeping the solution from partial decomposition through the action of light and air is a serious annoyance and interferes with the accuracy of the estimation.

POTASSII SULPHAS. *U.S.* Potassium Sulphate.

$K_2SO_4 = 173.88.$

Preparation.—Potassium sulphate is obtained as a by-product in many chemical processes, although since the introduction of sodium nitrate as the source of the nitrates it is not produced very largely. It is also obtained from *kainite*, the mineral found in the Stassfurt salt-beds, which is a double potassium and magnesium sulphate. If it should be necessary to make it directly at any time, it can be made by decomposing potassium nitrate with sulphuric acid.

$$\underset{\text{Potassium Nitrate.}}{2KNO_3} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Potassium Sulphate.}}{K_2SO_4} + \underset{\text{Nitric Acid.}}{2HNO_3}.$$

Potassii Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, hard, transparent, six-sided, rhombic prisms terminated by pyramids, or a white powder, permanent in the air. When heated, the crystals decrepitate; at a bright red heat they fuse, and at a white heat the salt suffers partial decomposition.	Odorless; slightly bitter, saline taste; neutral reaction.	At 15° C. (59° F.), 9.5 parts. Boiling, 4 parts.	Insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution of the salt yields a copious yellow precipitate with sodium cobaltic nitrite T.S., and a white, crystalline precipitate with excess of tartaric acid T.S.	Sodium.	When held in a non-luminous flame on a clean platinum wire, the salt should at once impart to the flame a violet color.
	Arsenic, Lead, Copper, etc.	The aqueous solution (1 in 20) should remain unaffected by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid,
	Zinc, Iron, Aluminum, etc.	Or by the addition of a small amount of ammonium sulphide T.S.
	Calcium.	Other portions of the aqueous solution should not be rendered turbid by the addition of ammonium oxalate T.S.,
	Magnesium.	Or of sodium phosphate T.S. and ammonia water,
	Chloride.	Or of silver nitrate T.S.
	Iron.	The addition of potassium ferrocyanide T.S. should not produce a blue color,
	Copper.	Or a red color.

Uses.—The principal use for potassium sulphate in pharmacy has been to act as a diluent in powdering ipecac and opium in the so-called Dover's powder. It is well adapted for this purpose, for, on account of the hardness of the crystals, the ingredients are thoroughly blended during the time required to produce a fine powder. Sugar of milk is employed now as a substitute for it, although many still continue to use potassium sulphate.

QUESTIONS ON CHAPTERS XXXVII. AND XXXVIII.

THE ALKALIES AND THEIR COMPOUNDS AND THE POTASSIUM SALTS.

What are alkalies, and what are their properties?
What are the alkali-metals, and their properties?
How many chlorides are obtained from the alkali-metals?
Are their oxides acid or basic?
Are the alkaline hydrates decomposable by heat?
What is the process for obtaining the alkali-metals?
What is ammonium, and why is it classed with the metals?
What was formerly the source of the potassium salts?
What is the present source, and how are they obtained?

How may potassium in its combinations be recognized?
Potassa—Give formula in symbols and molecular weight.
What is caustic potash, and how is it made?
What is meant by "potassa by alcohol"?
What is meant by "potassa by barytes"?
What are the physical properties of potassa?
How may the following impurities be detected?—viz.: Organic matter; chloride; sulphate; carbonate; silica
For what is potassa used?
How much water does commercial caustic potassa usually contain?
What is potassa with lime, and how is it prepared?
What is its medicinal use?
What is solution of potassa, and how is it made?
What is its Latin official name?
How much potassium hydrate does it contain?
By what other process may it be made?
How strong should the potassa be? and if the potassa is not of the proper strength, how may it be used?
Explain the chemical reaction which takes place between the lime and the potassium bicarbonate in making this solution.
Why is potassium bicarbonate used in preference to the carbonates (which are cheaper) in preparing this solution?
Is the proportion of water used in making the solution of the bicarbonate a matter of indifference? How much should be used?
Should more than the theoretical quantity of lime be used? Why?
How is this solution injured by exposure to air?
What are the advantages of the alternative formula?
How may this solution be distinguished from solution of soda?
How may the following impurities be detected?—viz.: Carbonate; alkaline earths; sulphate; chloride; foreign impurities.
What is its medicinal use? Give the dose.
If a large quantity should be swallowed, what would be the proper antidotes?
What is sulphurated potassa, and how is it made?
Is this a definite chemical compound?
Explain the chemical reaction which probably takes place between the carbonate and the sulphur.
What is the common or popular name of this preparation?
Does it deteriorate by keeping? What change takes place?
How may it be identified as a potassium salt?
What percentage of potassium sulphide should be present?
How may it be shown whether it contains this amount?
Explain the reaction which takes place when cupric sulphate and potassium sulphide are mixed in the presence of water.
What is its medicinal use? Give its dose.
Potassii acetas—Give formula in symbols and molecular weight.
How may this salt be made?
Explain the chemical reaction which takes place between potassium bicarbonate and acetic acid.
What are its solubilities?
How may it be identified?
What are the tests for the following impurities?—viz.: Chloride; sulphate; silica; metals; alkaline earths; carbonate; organic impurities.
What are its uses in medicine? Give its dose.
Potassii bicarbonas—Give formula in symbols and molecular weight.
How is it made?
What is salæratus, and how is it prepared?
What are the physical properties of potassium bicarbonate?
What are its solubilities?
How much of its weight does it lose at a red heat?
How may it be identified?
How may the following impurities be detected?—viz.: Sulphate; chloride; carbonate.
What are the uses of this salt, and what is the dose?
Potassium bichromate—Give formula in symbols and molecular weight.
What is the source of this salt, and where is it found?

How is the salt prepared?
Explain the chemical reactions which take place.
What is supposed to be the chemical composition of this salt?
What are its physical properties?
What are its solubilities?
How may it be identified?
How may the presence of a sulphate be detected?
For what is this salt used?
What is its proper dose? What is the effect of large doses?
In case of poisoning by it, what would be proper antidotes?
Cream of tartar—Give formula in symbols and molecular weight.
How is it made?
What are argols?
Give the physical properties of cream of tartar.
What are its solubilities?
How may it be identified?
How may the following impurities be detected?—viz.: Sulphate; chloride; metals; more than 6 per cent. of calcium tartrate.
What chemical substance besides potassium bitartrate is always present in grape juice?
How much of this impurity is permitted by the official test?
For what purposes in pharmacy is it used?
What are its medicinal uses? Give the dose.
Potassium bromide—Give formula in symbols and molecular weight.
What process was formerly official for making this salt?
Explain the chemical reaction which takes place.
In what other way may it be made?
Explain the reaction which takes place.
Where does this salt come from?
Describe its physical properties and solubilities.
How may it be identified?
How may the following impurities be detected?—viz.: Bromate; iodide; sulphate; more than 3 per cent. of chloride; more than 0.1 per cent. of alkali.
Upon what does the official test to indicate the presence of more than 3 per cent. of chloride depend?
What is its medicinal use? Give the dose.
Potassium carbonate—Give formula in symbols and molecular weight.
What is the commercial name of this salt?
How is it made?
How may a purer carbonate be produced?
What reaction takes place when potassium bicarbonate is heated to redness?
Describe the physical properties of potassium carbonate.
What are its solubilities?
How much pure anhydrous potassium carbonate should it contain?
How may this be tested?
How may the following impurities be detected?—viz.: Silica; alkaline earths; chloride; sulphate.
What is its medicinal use, and what is the dose?
What are its effects in an overdose?
What are the proper antidotes to administer?
Potassium chlorate—Give formula in symbols and molecular weight.
How was this formerly made?
What is the objection to this process?
How is it now prepared?
Explain the reactions which take place in its preparation.
Describe its physical properties and solubilities.
How may it be identified?
How may the following impurities be detected?—viz.: Sulphate; calcium; chloride.
What follows when potassium chlorate is triturated with readily oxidizable or combustible substances?
For what is potassium chlorate used chemically?
What is its medicinal use? Give the dose.
Potassium citrate—Give formula in symbols and molecular weight.
How is this salt made?

When made from carbonate instead of potassium bicarbonate, what impurity is apt to be present?
What are its physical properties and solubilities?
How may it be identified?
How may the following impurities be detected?—viz.: Carbonate; sulphate; chloride; tartrate.
What are its medicinal uses? Give the dose.
Into what official preparation does it enter?
Give the Latin name, formula, and mode of preparation of efflorescent potassium citrate.
Potassium cyanide—Give formula in symbols and molecular weight.
What is the process for making this salt, which was formerly official?
Explain the reaction which takes place between potassium ferrocyanide and potassium carbonate.
In what form does it occur in commerce?
Describe the physical properties of the official salt.
What are its solubilities?
How may it be identified?
What per cent. of pure potassium cyanide should it contain, and how may this be tested?
How may the impurity of carbonate be detected?
What is the medicinal use of it, and what is the dose?
What advantage has it over hydrocyanic acid?
Rochelle salt—Give formula in symbols and molecular weight.
How is this salt made?
Explain the reaction which takes place.
What is meant by saying that tartaric acid is a dibasic acid?
Describe its physical properties and solubilities.
How may its identity and purity be tested?
What are the tests for the following impurities?—viz.: Calcium; sulphate; chloride; ammonium salts.
What is its medicinal use, and what is the dose?
Potassium ferrocyanide—Give formula in symbols and molecular weight.
How is this salt made?
What reaction takes place when potassium cyanide is mixed with ferrous carbonate in the presence of water?
What renders this salt important?
Describe its physical properties and solubilities.
What are the tests for the following impurities?—viz.: Carbonate; sulphate; chloride.
Is this salt poisonous?
Of what importance is it chemically?
Potassium hypophosphite – Give formula in symbols and molecular weight.
How may this salt be prepared?
Explain the reaction which takes place.
Should the evaporation of the solution be conducted at a high heat or a low one? Why?
How may the salt be rendered pure?
Describe its physical properties and solubilities.
How may it be identified?
What are the tests for the following impurities?—viz.: Carbonate; calcium; sulphate; phosphate.
Into what official preparation does it enter?
What is the dose of it?
Potassium iodide—Give formula in symbols and molecular weight.
How is it prepared, and what reaction takes place?
Should it be crystallized from an acid or an alkaline solution? Why?
The presence of how much alkali is permitted by the official test?
How may it be identified?
What are the tests for the following impurities?—viz.: Iodate; more than about 0.5 per cent. of chloride or bromide; sulphate.
What are its uses, and what is the dose?
Potassium nitrate—Give formula in symbols and molecular weight.
Where does it come from?
How is it made?

Describe its physical properties and solubilities.
How may it be identified?
What are the tests for the following impurities?—viz.: **Metals; alkaline earths; sulphate; chloride.**
What are its uses? What is the dose?
Potassium permanganate—Give formula in symbols and molecular weight.
What is the British process for making this salt?
Explain the reactions which take place in its formation.
Describe its physical properties and solubilities.
How may its identity and purity be tested?
How may the following impurities be detected?—viz.: **Nitrate; chloride; sulphate.**
Why is the cautionary official note appended, as follows?—viz.: "It should not be brought in contact with organic or readily oxidizable substances."
What renders it useful as a disinfectant, and what special care should be used in its application?
How and why is it used chemically?
Potassium sulphate—Give formula in symbols and molecular weight.
How is this salt obtained?
Describe its physical properties and solubilities.
How may its identity and purity be tested?
What are the tests for the following impurities?—viz.: **Alkaline earths; metals; chloride.**
For what was it formerly used in pharmacy?
What is now used as a substitute for it?
Solution of potassium citrate—What is its official Latin name?
How is it made?
How much potassium citrate does it contain?
What is the dose?

CHAPTER XXXIX.

THE SODIUM SALTS.

THE sodium salts are generally more frequently used than those having potassium for their base, because they are relatively cheaper, and are often more soluble. The metal *Sodium* is a soft, malleable, ductile solid, which must be protected from the oxygen of the air by being constantly immersed in petroleum or naphtha.

Tests for Sodium Salts.

Sodium may be recognized in its salts by the following reactions:

1. The intensely yellow color produced when even a trace of a sodium compound is introduced into a colorless flame.

2. A reliable and practical precipitant is yet to be discovered for the sodium salts, because the compounds are generally very soluble. Neutral solutions may be precipitated by potassium metantimoniate: this reaction, however, has but a limited application.

3. Sodium salts are generally colorless, and not volatile below a red heat.

Official Sodium Salts and Preparations.

Official Name.	Preparation.
With Inorganic Radicals.	
Soda	By boiling solution of sodium carbonate with calcium hydrate and evaporating.
Sodii Arsenas	By heating together arsenous acid, sodium nitrate, and sodium carbonate.
Sodii Bicarbonas	By exposing sodium carbonate to the action of carbon dioxide.
Sodii Bisulphis	By saturating a solution of sodium carbonate with sulphurous acid.
Sodii Boras	By purifying the native salt.
Sodii Bromidum	By treating ferrous bromide with sodium carbonate.
Sodii Carbonas	By heating sodium sulphate with chalk and coal.
Sodii Carbonas Exsiccatus	By heating the carbonate.
Sodii Chloras	By double decomposition between sodium bitartrate and potassium chlorate.
Sodii Chloridum	By evaporating sea-water.
Sodii Hypophosphis	By double decomposition between calcium hypophosphite and sodium carbonate.
Sodii Hyposulphis	By decomposing calcium thiosulphate with sodium sulphate.
Sodii Iodidum	By treating ferrous iodide with sodium carbonate.
Sodii Nitras	By purifying the native salt.
Sodii Nitris	By decomposing sodium nitrate by heating in contact with starch, lead, or other reducing substances.

Official Sodium Salts and Preparations.—*Continued.*

Official Name.	Preparation.
With Inorganic Radicals.	
Sodii Phosphas	By treating acid calcium phosphate with sodium carbonate.
Sodii Pyrophosphas	By heating sodium phosphate to redness, dissolving and crystallizing.
Sodii Sulphas	By treating common salt with sulphuric acid.
Sodii Sulphis	By decomposing sodium carbonate with sulphurous acid.
Liquor Sodæ	By dissolving sodium hydrate in water.
Liquor Sodæ Chloratæ	Double decomposition between chlorinated lime and sodium carbonate.
Liquor Sodii Arsenatis	1 per cent. solution of exsiccated sodium arsenate.
Liquor Sodii Silicatis	Solution of sodium silicate.
Trochisci Sodii Bicarbonatis	Each contains three grains of sodium bicarbonate.
With Organic Radicals.	
Sodii Acetas	By decomposing sodium carbonate with acetic acid.
Sodii Benzoas	By decomposing sodium carbonate with benzoic acid.
Sodii Salicylas	By decomposing sodium carbonate with salicylic acid.
Sodii Sulphocarbolas	By double decomposition between barium sulphocarbolate and sodium carbonate.
Mistura Rhei et Sodæ	Contains sodium bicarbonate.

Unofficial Preparations of Sodium.

Sodii Carbolas, NaC_6H_5O. Sodium Carbolate.	Add metallic sodium to carbolic acid, and allow it to crystallize.
Sodii Citras, $2C_6H_5Na_3O_7.11H_2O$. Sodium Citrate.	Saturate a solution of citric acid with sodium bicarbonate, evaporate, and allow it to crystallize.
Sodii-Citro-Tartras Effervescens. Effervescent Sodium Citro-tartrate.	17 p. sodium bicarbonate; 8 p. tartaric acid; 6 p. citric acid. Mix, and place in a dish heated to about 200° F. Stir constantly until a granular salt is obtained. Lastly, sift it.
Sodii et Ammonii Phosphas, $NH_4NaHPO_4.4H_2O$. Sodium and Ammonium Phosphate.	Dissolve 5 p. crystallized sodium phosphate and 2 p. ammonium phosphate in 20 p. hot water; then add ammonia water until the liquid is alkaline, and crystallize.
Sodii et Argenti Hyposulphis, $2Na_2S_2O_3 + Ag_2S_2O_3$. Sodium and Silver Hyposulphite.	Dissolve freshly precipitated silver oxide in a solution of sodium hyposulphite, and evaporate to crystallize.
Sodii Ethylas, C_2H_5NaO. Sodium Ethylate.	Caustic. Used in alcoholic solution; also applied externally mixed with olive oil.
Sodii Nitro-Prussidum, $Na_2Fe(CN)_5NO.2H_2O$. Sodium Nitro-Prusside.	Digest 1 p. potassium ferrocyanide with 2 p. nitric acid and 2 p. water until it ceases to produce a blue precipitate with iron salts. When cool, neutralize the mother-liquid with sodium carbonate, then collect the red crystals.
Sodii et Platini Chloridum, $2NaCl.PtCl_4.6H_2O$. Sodium and Platinum Chloride.	Dissolve 3 p. platinic chloride and 5 p. sodium chloride in water, and evaporate to dryness, stirring continually.
Sodii Silicas, Na_2SiO_3. Sodium Silicate.	Mix 1 p. silica and 2 p. dried sodium carbonate; fuse in an earthen-ware crucible, and pour the mass on a slab. Dissolve in water, filter, and concentrate to crystallize.
Sodium Silico-Fluoride, Na_2SiF_6.	Antiseptic. A mild caustic.
Sodii Stannas, Na_2SnO_3. Sodium Stannate.	Fuse tin-ore with soda and sodium nitrate.
Sodii Sulphobenzoas, $C_6H_4(NaSO_3)COONa$. Sodium Sulphobenzoate.	Non-poisonous antiseptic.
Sodii Ethylsulphas, $C_2H_5NaSO_4.H_2O$. Sodium Sulphovinate, Sodium Ethylsulphate.	Cathartic. The dose for children is from 2 to 3 drachms.
Sodii Tartras, $Na_2C_4H_4O_6.2H_2O$. Sodium Tartrate.	Dissolve 6 p. tartaric acid and 7½ p. sodium bicarbonate, each separately, in water. Mix the solutions, filter, and concentrate to crystallize.
Sodii Valerianas, $NaC_5H_9O_2$. Sodium Valerianate.	Saturate valerianic acid with sodium carbonate.

SODA. *U. S.* Soda.

$NaOH$; 39.96.

[Sodium Hydrate. Sodium Hydroxide. Caustic Soda.]

Preparation.—Owing to the improvements in the manufacture of metallic sodium and the cheapening of the product, soda can be found in commerce which has been made by oxidizing the metal by bringing it in contact with water and evaporating the pure solution of soda. When the pure hydrate is not needed, the white caustic soda, in sticks, made by evaporating a solution of soda (see Liquor Sodæ) and casting the fused residue into moulds, is used. (See Potassa, page 524.)

Soda. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Dry, white, translucent pencils, or fused masses, showing a crystalline fracture. Great caution is necessary in tasting and handling it, as it rapidly destroys organic tissues. Exposed to the air, it rapidly deliquesces, absorbs carbon dioxide, and becomes covered with a dry coating of carbonate.	Odorless; acrid and caustic taste; strongly alkaline reaction.	At 15° C. (59° F.), 1.7 parts. Boiling, 0.8 part.	Very soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated to about 525° C. (977° F.), Soda melts to a clear, oily liquid, and at a bright red heat it is slowly volatilized unchanged. When introduced into a non-luminous flame, it imparts to it an intensely yellow color. To neutralize 0.4 Gm. of Soda should require not less than 9 C.c. of normal sulphuric acid (each C.c. corresponding to 10 per cent. of pure sodium hydrate), phenolphtalein being used as indicator.	Organic Matter.	The aqueous solution of Soda should be colorless.
	Potassium.	After being acidulated with acetic acid separate portions of it should yield no precipitate on the addition of platinic chloride T.S., or sodium cobaltic nitrite T.S., or excess of tartaric acid T.S.
	Arsenic, Copper, Lead, etc.	If 1 Gm. of Soda be dissolved in 10 C.c. of water and the solution slightly supersaturated with acetic acid, 10 C.c. of the solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S.,
	Iron, Aluminum, etc.	Nor by the subsequent addition of ammonia water in slight excess.
	Calcium.	The remainder of the acidulated solution should not be rendered turbid by ammonium oxalate T.S.
	Chloride.	If a solution of 1.2 Gm. of Soda in 10 C.c. of water be slightly supersaturated with nitric acid, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S.
	Sulphate.	If to a solution of 2.5 Gm. of Soda in 10 C.c. of water, strongly supersaturated with hydrochloric acid, 0.1 C.c. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.
	Silicate, etc.	If 0.7 Gm. of Soda be dissolved in 1.5 C.c. of water, and the solution added to 10 C.c. of alcohol, not more than a slight, white precipitate should occur within 10 minutes.
	Carbonate.	After boiling this alcoholic solution with 5 C.c. of calcium hydrate T.S. and filtering, not the slightest effervescence should take place on adding the filtrate to an excess of diluted hydrochloric acid.
	Nitrate.	If 0.2 Gm. of Soda be dissolved in 2 C.c. of water, and carefully mixed with 5 C.c. of pure sulphuric acid and 3 drops of indigo T.S., the blue color should not be entirely discharged.

Uses.—*Caustic Soda,* as it is termed commercially, is sometimes preferred to the analogous potassium salt, in the belief that it is milder and less deliquescent. It is used pharmaceutically in making solution of soda by the *alternative* process.

LIQUOR SODÆ. *U.S.* Solution of Soda.

[SOLUTION OF SODIUM HYDRATE.]

An aqueous solution of Sodium Hydrate [$NaOH = 39.96$], containing about 5 per cent. of the hydrate.

	Metric.	Old form.
Sodium Carbonate	170 Gm.	6 oz. av.
Lime	50 Gm.	1 oz. av. 334 grains.
Distilled Water, a sufficient quantity.		

Dissolve the Sodium Carbonate in 400 C.c. [old form 13 fl. oz.] of boiling Distilled Water. Slake the Lime with about 30 C.c. [old form 1 fl. oz.] of Distilled Water, then mix it well with 400 C.c. [old form 13 fl. oz.] of Distilled Water, pour the mixture into a tared flask, and, having heated it to boiling, gradually add to it the solution of Sodium Carbonate, and boil during ten minutes. Then add enough Distilled Water to the flask to make the contents weigh 1000 Gm. [old form 2 pints], and set the flask aside, well stoppered, until the contents are cold. Lastly, strain the liquid through linen, set it aside in a well-stoppered bottle until it has become clear by subsidence, and separate the clear solution by decantation, or by means of a siphon.

Solution of Soda may also be prepared in the following manner:

	Metric.	Old form.
Soda	56 Gm.	1 oz. av.
Distilled Water	944 Gm.	1 pint.
To make	1000 Gm.	about 1 pint.

Dissolve the Soda in the Distilled Water.

The Soda used in this process should be of the full strength directed by the Pharmacopœia (90 per cent.). Soda of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken; the proper amount for the above formula being ascertained by dividing 5000 by the percentage of absolute Soda (sodium hydrate) contained therein.

Solution of soda should be kept in bottles made of green glass, and provided with glass stoppers coated with paraffin or petrolatum.

The sodium hydrate is obtained in this process by decomposing the carbonate by heating it in contact with an aqueous mixture of calcium hydrate: calcium carbonate is formed, and sodium hydrate remains in solution.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Calcium Hydrate.}}{Ca(HO)_2} = \underset{\text{Sodium Hydrate.}}{2NaHO} + \underset{\text{Calcium Carbonate.}}{CaCO_3}.$$

Liquor Sodæ. *U. S.*	Odor, Taste, and Reaction.
A clear, colorless liquid. When dropped into a concentrated solution of tartaric acid, no precipitate is produced (difference from solution of potassa). Sp. gr. about 1.059 at 15° C. (59° F.).	Odorless; very acrid and caustic taste; strongly alkaline reaction.

Quantitative Test.
To neutralize 20 Gm. of Solution of Soda should require 25 C.c. of normal sulphuric acid V.S. (each C.c. of the volumetric solution indicating 0.2 per cent. of absolute sodium hydrate), phenolphtalein being used as indicator. It should conform to the same reactions and tests as an aqueous solution of Soda. (See *Soda*.)

Uses.—Solution of soda is an antacid, and is used for the same purposes and in the same dose as solution of potassa (see p. 527).

SODII ACETAS. *U. S.* Sodium Acetate.

$$NaC_2H_3O_2 + 3H_2O = 135.74.$$

Preparation.—This salt is obtained on the large scale in the process for making acetic acid. For medicinal purposes it may be made conveniently by saturating acetic acid with sodium carbonate, filtering the solution, concentrating it, and obtaining the salt in crystals.

$$\underset{\text{Acetic Acid.}}{2HC_2H_3O_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Acetate.}}{2NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

It is sometimes granulated, and in this form it is more convenient for dispensing purposes than the usual large crystals.

Sodii Acetas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, monoclinic prisms, or a granular, crystalline powder, efflorescent in warm, dry air. When heated to 60° C. (140° F.), the salt begins to liquefy. At 123° C. (253.4° F.), it becomes dry and anhydrous; at 315° C. (599° F.), it is decomposed with evolution of inflammable, empyreumatic vapors, leaving a black residue of sodium carbonate and carbon, which imparts to a non-luminous flame an intensely yellow color, gives an alkaline reaction with litmus paper, and effervesces with acids.	Odorless; cooling, saline taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 1.4 parts. Boiling, 0.5 part.	At 15° C. (59° F.), 30 parts. Boiling, 2 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution (1 in 20) of the salt colors litmus paper or T.S. blue, but does not redden phenolphtalein T.S. unless carbonate be present.	Potassium.	If a non-luminous flame be colored by the introduction of the salt, and viewed through a blue glass, the yellow color should entirely disappear, no red color taking its place.
If 5 C.c. of the aqueous solution be heated with 1 C.c. of sulphuric acid and 0.5 C.c. of alcohol, acetic ether will be formed, recognizable by its odor.	Arsenic, Lead, Zinc, etc.	If to 5 C.c. of the aqueous solution (1 in 20), slightly acidulated with acetic acid, an equal volume of hydrogen sulphide T. S. be added, no color or turbidity should appear either at once
	Iron, etc.	Or after adding ammonia water in slight excess.

TESTS.—(*Continued.*)

TESTS FOR IDENTITY AND QUANTITATIVE TEST.	IMPURITIES.	TESTS FOR IMPURITIES.
On the addition of a few drops of ferric chloride T.S., the solution assumes a deep red color, and, when boiled, yields a brown precipitate. If 1.36 Gm. of Sodium Acetate be completely decomposed at a red heat, and the residue dissolved in water, it should require for complete neutralization 10 C.c. of normal sulphuric acid (corresponding to 100 per cent. of the pure salt), methyl-orange being used as indicator.	Calcium.	The aqueous solution, acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S.
	Limit of Chloride.	If a solution of 1 Gm. of the salt in 50 C.c. of water be slightly acidulated with nitric acid, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S.
	Limit of Sulphate.	If to a solution of 2 Gm. of the salt in 10 C.c. of water, acidulated with hydrochloric acid, 0.1 C.c. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.

Uses.—Sodium acetate is often preferred to potassium acetate as a diuretic. It is not deliquescent like the latter, and is said to be as efficient, although milder in its action. The dose is from twenty to sixty grains (1.3 to 3.8 Gm.).

SODII ARSENAS. *U.S.* Sodium Arsenate.

$Na_2HAsO_4 + 7H_2O = 311.46.$

[SODII ARSENIAS, PHARM. 1880.]

Preparation.—A process for this salt was formerly official: it is as follows:

Take of Arsenious Acid, in fine powder, 960 *grains;* Nitrate of Sodium, in fine powder, 816 *grains;* Dried Carbonate of Sodium, in fine powder, 528 *grains;* Distilled Water, boiling hot, *half a pint.* Having mixed the powders thoroughly, put the mixture into a large clay crucible, and cover it with the lid. Expose it to a full red heat until effervescence has ceased and complete fusion has taken place. Pour the fused salt on a porcelain slab, and, as soon as it has solidified, and while it is still warm, put it into the hot water, and stir until it is dissolved. Filter the solution, and set it aside to crystallize. Drain the crystals, and, having dried them rapidly on filtering paper, keep them in a well-stopped bottle.

The rationale of this process is that when arsenous acid, sodium nitrate, and sodium carbonate are fused together, sodium pyroarsenate is formed, whilst nitrous anhydride and carbon dioxide escape as gases.

$$\underset{\text{Arsenous Acid.}}{As_2O_3} + \underset{\text{Sodium Nitrate.}}{2NaNO_3} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Pyroarsenate.}}{Na_4As_2O_7} + \underset{\text{Nitrous Anhydride.}}{N_2O_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

Sodium pyroarsenate is converted into the orthoarsenate (the official salt) by dissolving the former in water, filtering the solution, and crystallizing.

$$\underset{\text{Sodium Pyroarsenate.}}{Na_4As_2O_7} + \underset{\text{Water.}}{15H_2O} = \underset{\text{Sodium Orthoarsenate.}}{2(Na_2HAsO_4,7H_2O)}.$$

Sodii Arsenas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.
Colorless, transparent, monoclinic prisms, efflorescent in dry air, and somewhat deliquescent in moist air. When gently heated, the salt loses 5 molecules of water (28.8 per cent.), and is converted into a white powder. At 148° C. (298.4° F.) the rest of the water of crystallization is lost, the salt fuses, and at a red heat is converted into pyroarsenate. It imparts an intensely yellow color to a non-luminous flame.	Odorless; mild, alkaline taste (the salt is very poisonous); faintly alkaline reaction.	At 15° C. (59° F.), 4 parts. Boiling, Very soluble.	At 15° C. (59° F.), Very slightly soluble. Boiling, 60 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution (1 in 20) of the salt yields a white precipitate with barium chloride T.S., or with calcium chloride T.S., and a dark red precipitate with silver nitrate T.S., all of which precipitates are soluble in nitric acid. If 0.5 C.c. of the aqueous solution (1 in 20) be mixed with 2 C.c. of hydrochloric acid, a drop of this mixture be placed upon a bright piece of copper-foil, and a gentle heat applied, a dark steel-gray film will be deposited from the drop upon the copper.	Arsenite.	If to 2 C.c. of the aqueous solution (1 in 20) 5 C.c. of decinormal silver nitrate V.S. be added, and the precipitate redissolved by excess of ammonia water, no black precipitate of reduced silver should appear on boiling.
	Lead, Copper, Iron, etc.	If to 5 C.c. of the aqueous solution 1 C.c. of ammonium sulphide T.S. be added, no turbidity or coloration should appear.

Uses.—The only advantage in using this salt in preference to arsenous acid is that the practitioner is more apt to get it of uniform quality: their properties are identical. The dose is from one-twelfth to one-third of a grain (0.005 to 0.02 Gm.).

SODII BENZOAS. *U. S.* Sodium Benzoate.

$NaC_7H_5O_2 = 143.71.$

Preparation.—Benzoic acid is added to a hot concentrated solution of pure sodium carbonate until effervescence ceases. The solution is evaporated, cooled, and allowed to crystallize, or, preferably, evaporated to dryness and granulated.

$$\underset{\text{Benzoic Acid.}}{2HC_7H_5O_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Benzoate.}}{2NaC_7H_5O_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

The yield of granulated salt is about one and one-third times the quantity of benzoic acid used.

Sodii Benzoas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.
A white, amorphous powder, efflorescent on exposure to air. When heated, the salt melts, emits vapors having the odor of benzoic acid, then chars, and finally leaves a residue of sodium carbonate and carbon. To a non-luminous flame it imparts an intensely yellow color.	Odorless, or having a faint odor of benzoin; sweetish, astringent taste; neutral reaction.	At 15° C. (59° F.), 1.8 parts. Boiling, 1.3 parts.	At 15° C. (59° F.), 45 parts. Boiling, 20 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
If a few drops of ferric chloride T.S. be added to an aqueous solution of the salt, a flesh-colored precipitate will be deposited.	Chloride.	The filtrate from the precipitated benzoic acid should not be rendered turbid by silver nitrate T.S.,
If 5 C.c. of diluted nitric acid be added to a solution of 1 Gm. of the salt in 10 C.c. of water, a white precipitate of benzoic acid will be produced, which, after being thoroughly washed, should conform to the tests of purity given under Acidum Benzoicum.	Sulphate.	Nor by barium chloride T.S.
	Potassium.	Five C.c. of the aqueous solution (1 in 20) should not give a precipitate with 0.5 C.c. of sodium cobaltic nitrite T.S.
If 2 Gm. of Sodium Benzoate be ignited in a porcelain capsule until most of the carbonaceous matter is destroyed, and the residue be then dissolved in 20 C.c. of water, it should require for complete neutralization not less than 13.9 C.c. of normal sulphuric acid (corresponding to at least 99.8 per cent. of the pure salt), methyl-orange being used as indicator.	Lead, Iron, etc.	If to 5 C.c. of the aqueous solution (1 in 20) an equal volume of hydrogen sulphide T.S. be added, no coloration or turbidity should be perceptible either before or after the addition of 1 C.c. of ammonia water.

Uses.—Sodium benzoate has been prescribed as a remedy in phthisis, diphtheria, and similar complaints, in sixty-grain doses (3.8 Gm.). It is employed also in rheumatism.

SODII BICARBONAS. *U. S.* Sodium Bicarbonate.

$NaHCO_3 = 83.85.$

All the processes for making this important salt of sodium, with one exception, consist in the addition of carbon dioxide to sodium carbonate. This operation cannot be carried on profitably upon the small scale: hence it is most advantageous for the pharmacist to buy commercial sodium bicarbonate and purify it for dispensing purposes (see page 560). Sodium carbonate contains ten molecules of water of crystallization; sodium bicarbonate contains none: hence provision must be made for the escape of this water, which is thrown out of combination during the process of carbonating. The crystallized sodium carbonate is placed upon false bottoms in chambers arranged so that the water can escape as it is liberated.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Sodium Bicarbonate.}}{2HNaCO_3}.$$

Sodium bicarbonate is also prepared by the ammonia-soda process, or *Solvay's*, as it is usually called. In this, carbon dioxide is passed into a solution of common salt in ammonia water, double decomposition ensues, sodium bicarbonate is precipitated, and ammonium chloride, being very soluble, remains in solution.

$$\underset{\text{Sodium Chloride.}}{NaCl} + \underset{\text{Ammonia.}}{NH_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Sodium Bicarbonate.}}{HNaCO_3} + \underset{\text{Ammonium Chloride.}}{NH_4Cl}.$$

In the U. S. P. 1880 two sodium bicarbonates were official, "commercial" and "purified:" the former has been dropped, and Sodii

Bicarbonas is alone admitted to the U.S.P. 1890. This is not the ordinary "Bicarbonate of Soda:" the official requirement being that it shall contain 98.6 per cent. of sodium bicarbonate. In order to attain this high grade, it is necessary to purify the commercial salt. This may be done by the process formerly official:

Take of Commercial Bicarbonate of Sodium, in powder, 64 oz. av.; Distilled Water, 6 pints. Introduce the powder into a suitable conical glass percolator, cover it with a piece of wet muslin, and pour the Water gradually upon it. When the liquid has ceased to drop, or when the washings cease to precipitate a solution of Sulphate of Magnesium, remove the Bicarbonate of Sodium from the percolator, and dry it on bibulous paper, in a warm place.

This purification amounts to nothing more than washing the salt with distilled water. The common impurities, sodium carbonate, chloride, and sulphate, and ammonium salts, are much more soluble than the bicarbonate, and they are easily dissolved out, without any serious loss of the bicarbonate. Alcohol is sometimes substituted for water for dissolving the carbonate.

Sodii Bicarbonas. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
A white, opaque powder, permanent in dry air, but slowly decomposed in moist air. When heated, the salt is decomposed into normal carbonate, water, and carbon dioxide, and finally, at 100° C. (212° F.), loses about 36.3 per cent. of its weight. At a bright red heat it melts. To a non-luminous flame it imparts an intensely yellow color.	Odorless; cooling, mildly alkaline taste; slightly alkaline reaction.	At 15° C. (59° F.), 11.3 parts. Boiling, Decomposed.	Insoluble.	Insoluble in ether.

Tests for Purity and Quantitative Test.	Impurities.	Tests for Impurities.
If Sodium Bicarbonate be heated in a test-tube, no *ammoniacal* vapor should be emitted.	Sulphocyanate.	If 5 C.c. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the liquid should not be colored red by a drop of ferric chloride T.S.
To neutralize 0.85 Gm. of Sodium Bicarbonate should require not less than 10 C.c. of normal	Limit of Potassium.	If 1 Gm. of the salt be dissolved in 3 C.c. of acetic acid, it should yield no precipitate within an hour after being mixed with 0.5 C.c. of sodium cobaltic nitrite T.S.
sulphuric acid (corresponding to at least 98.6 per cent. of the pure salt), methyl-orange being used as indicator.	Limit of Normal Carbonate.	If 0.6 Gm. of the salt be dissolved, without agitation, in 10 C.c. of cold water, and 0.1 C.c. of normal sulphuric acid added, no red color should appear upon the addition of 2 drops of phenolphtalein T.S.
The solution, when freshly prepared with cold, distilled water, without shaking, gives a very faint alkaline reaction	Arsenic.	If 5 C.c. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the solution should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either at once,
upon litmus paper. The alkalinity increases by	Iron, Aluminum, etc.	Or after the addition of ammonia water in slight excess.
standing, agitation, or increase of temperature. With acids the solution effervesces strongly.	Calcium.	Five C.c. of the aqueous solution, acidulated with acetic acid, should not be rendered turbid by 0.5 C.c. of ammonium oxalate T.S.

TESTS.—(*Continued.*)

TESTS FOR PURITY AND QUANTITATIVE TEST.	IMPURITIES.	TESTS FOR IMPURITIES.
If 1 Gm. of the salt be dissolved in 19 C.c. of water, it should yield a perfectly clear and colorless solution, leaving no residue.	Limit of Chloride.	If 1.2 Gm. of Sodium Bicarbonate be dissolved in 10 C.c. of diluted nitric acid, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S.
	Limit of Sulphate, Sulphite, and Hyposulphite.	If 2.5 Gm. of the salt be dissolved in 11 C.c. of diluted hydrochloric acid, then 0.1 C.c. of nitric acid and 0.1 C.c. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.

Uses.—If *official* sodium bicarbonate were universally used, the preparations into which the commercial article now enters would be largely deprived of the disagreeable, bitter taste which is caused by the presence of carbonate. Sodium bicarbonate is largely used as a safe antacid, in doses of ten to fifteen grains (0.6 to 0.9 Gm.). It is preferably administered in carbonic acid water, and the draught is popularly known as "extra soda." The misnomer is caused by the erroneous use of the term "soda water."

SODII BISULPHIS. *U. S.* Sodium Bisulphite.

$NaHSO_3$; 103.86.

Preparation.—The acid sodium sulphite is used in solution in the arts, but, owing to its unstable character, it is inferior to the normal sulphite. It is prepared by passing sulphurous acid gas into a solution of sodium carbonate until saturation takes place and all the carbon dioxide is expelled: the liquid is then evaporated, and the crystals which form on cooling are washed and dried.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Sulphurous Acid.}}{2H_2SO_3} = \underset{\text{Sodium Bisulphite.}}{2NaHSO_3} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

It is converted by exposure to the air into sulphate and carbonate. It is largely manufactured for use in the arts as an *antichlor*, to neutralize the effects of the chlorine used in bleaching fabrics.

Sodii Bisulphis. *U. S.*	ODOR, TASTE, AND REACTION.	SOLUBILITY.	
		Water.	Alcohol.
Opaque, prismatic crystals, or a granular powder, slowly oxidizing to sulphate and losing sulphur dioxide on exposure to air. When strongly heated, the salt decrepitates, emits vapors of sulphur and of sulphur dioxide, and leaves a residue of sodium sulphate. A small fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Sulphur dioxide odor; disagreeable, sulphurous taste; acid reaction.	At 15° C. (59° F.), 4 parts. Boiling, 2 parts.	At 15° C. (59° F.), 72 parts. Boiling, 49 parts.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On the addition of hydrochloric or sulphuric acid, the aqueous solution of the salt evolves sulphur dioxide, which is recognized by its odor, and by its blackening a strip of paper dipped into mercurous nitrate T.S. and held over the escaping gas.	Limit of Chloride.	If 1.2 Gm. of Sodium Bisulphite be dissolved in 10 C.c. of diluted nitric acid, and the solution heated sufficiently to expel the gases, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S.
If 0.26 Gm. of Sodium Bisulphite be dissolved in 20 C.c. of water, recently boiled to expel air, and a little starch T.S. be added, at least 45 C.c. of decinormal iodine V.S. should be required to produce a permanent blue tint after agitation (corresponding to at least 90 per cent. of pure Sodium Bisulphite).	Hyposulphite.	If 2.5 Gm. of Sodium Bisulphite be dissolved in 11 C.c. of diluted hydrochloric acid with the aid of sufficient heat to expel the sulphur dioxide, the solution should not be turbid.
	Limit of Sulphate.	After adding to it 0.15 C.c. of barium chloride T.S. and removing the precipitate, if any, by filtration, a portion of the clear filtrate should remain unaffected by the addition of more barium chloride T.S.
	Arsenic.	If to 5 C.c. of the preceding filtrate an equal volume of hydrogen sulphide T.S. be added, no turbidity or coloration should occur.

Uses.—Sodium bisulphite is used as an antiseptic and antiferment, in doses of five to ten grains (0.3 to 0.6 Gm.). The sulphite, however, is usually preferred.

SODII BORAS. *U.S.* Sodium Borate.

$Na_2B_4O_7 + 10H_2O = 380.92.$ [Borax.]

Preparation.—This salt is found in immense quantities in California as a crystalline deposit in the blue mud of an offset of Clear Lake. It is probable that this will continue to be the principal source of borax for many years to come. The process of purification consists simply in picking the large and perfect crystals out, washing them, and lixiviating the earth, which is strongly impregnated with borax, evaporating the solution, and crystallizing. It is sometimes called *biborate of sodium.*

Borax is found native in Thibet, Persia, and other localities. It is sometimes called *tincal.* Crude boric acid, obtained from Tuscany, is fused with dried sodium carbonate, and a hot solution of the residue is crystallized in order to produce borax.

Sodii Boras. U.S.	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvent.
Colorless, transparent, monoclinic prisms, or a white powder, slightly efflorescent in dry air. When heated, the powdered salt begins to lose water, then melts, on further heating swells up and forms a white, porous mass, which, at a red heat, fuses to a colorless glass, with complete loss of water of crystallization (47.14 per cent.).	Odorless; sweetish, alkaline taste; alkaline reaction.	At 15° C. (59° F.), 16 parts. Boiling, 0.5 part.	Insoluble.	At 80° C. (176° F.) it is soluble in 1 part of glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
A fragment of the salt imparts an intensely yellow color to a non-luminous flame. The aqueous solution (1 in 20) colors red litmus paper blue, and yellow turmeric paper reddish-brown. After being acidulated with hydrochloric acid, the solution colors blue litmus paper red; yellow turmeric paper remains unchanged at first, but, on drying, becomes brownish-red, and this color is temporarily changed to bluish-black by moistening with ammonia water.	Carbonate.	The aqueous solution (1 in 20) should not effervesce with acids.
If a drop of the solution of the salt in glycerin be held in the flame, a transient bright green color will appear.	Iron, Aluminum, etc.	It should not be rendered turbid by ammonium sulphide T.S.,
If a slight excess of sulphuric acid be added to a hot, saturated aqueous solution of the salt, shining, scaly crystals of boric acid will separate on cooling, which impart a green color to the flame of alcohol.	Arsenic, Lead, etc.	Nor, after being acidulated with hydrochloric acid, by an equal volume of hydrogen sulphide T.S.
With 19 C.c. of water, 1 Gm. of the salt should yield a perfectly clear and colorless solution, leaving no residue.	Calcium.	When acidulated with acetic acid, the solution should not be rendered turbid by ammonium oxalate T.S.
	Phosphate.	The aqueous solution (1 in 20) should not be rendered turbid by magnesia mixture.
	Limit of Chloride.	If 0.48 Gm. of the salt be dissolved in 15 C.c. of water, then 1 C.c. of diluted nitric acid and 0.2 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S.
	Limit of Sulphate.	If 2.5 Gm. of the salt be dissolved in 50 C.c. of water, then 10 C.c. of diluted hydrochloric acid and 0.1 C.c. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.
	Nitrate.	If 1 Gm. of the salt be dissolved in 20 C.c. of diluted sulphuric acid by the aid of heat, and three drops of indigo T.S. be added, the blue color should not be discharged.

Uses.—Borax, as it is almost universally called, is antacid and diuretic. It enters into many mouth-washes, and is frequently applied in the form of powder to ulcers in the mouth, for which purpose it is admirably adapted, being mildly alkaline and not very soluble. Pharmaceutically, it is frequently used in small quantity to whiten ointments, particularly the ointment of rose-water. It is used for this purpose by dissolving it in water, and incorporating the solution.

SODII BROMIDUM. *U. S.* Sodium Bromide.

NaBr; 102.76.

Preparation.—The process most used in making this salt is by decomposing ferrous bromide by treating it with sodium carbonate. The ferrous bromide is made by acting on iron wire with bromine in the presence of water, and, after filtering the solution, adding solution of sodium carbonate. The reaction may be thus expressed:

$$\underset{\text{Ferrous Bromide.}}{FeBr_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Bromide.}}{2NaBr} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

Sodium bromide may also be made by first producing ammonium bromide by treating a solution of ammonia with bromine (see Ammonii Bromidum), and then by double decomposition with sodium carbonate,

forming sodium bromide and ammonium carbonate. The solution, by careful evaporation and granulation, may be made to yield sodium bromide, whilst ammonium carbonate, being composed of volatile compounds, is dissipated by the amount of heat used to granulate the sodium salt.

Sodii Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless or white, cubical crystals, or a white, granular powder. From the air the salt attracts water without deliquescing. When heated to a dull red heat, the salt melts without losing weight. At a full red heat it is slowly volatilized without decomposition. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Odorless; saline, slightly bitter taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 1.2 parts. Boiling, 0.5 part.	At 15° C. (59° F.), 13 parts. Boiling, 11 parts.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If a few drops of chloroform be poured into 10 C.c. of the aqueous solution (1 in 20), then 1 C.c. of chlorine water added, and the mixture agitated, the liberated bromine will dissolve in the chloroform, imparting to it a yellow or brownish-yellow color, without a violet tint.	Limit of Potassium.	The aqueous solution (1 in 20) should be clear and colorless, and should not be rendered turbid by sodium bitartrate T.S., nor by sodium cobaltic nitrite T.S.,
	Calcium.	Nor by ammonium oxalate T.S.,
	Sulphate.	Nor by barium chloride T.S.
	Arsenic, Lead, etc.	If the aqueous solution be slightly acidulated with hydrochloric acid, it should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S. either at once,
	Iron, Aluminum, etc.	Or after adding ammonia water in slight excess.
	Bromate.	If diluted sulphuric acid be dropped upon some of the powdered salt, no yellow color should appear at once.
	Iodine.	If 5 C.c. of the aqueous solution (1 in 20) be mixed with a few drops of starch T.S., and then 0.5 C.c. of chlorine water be added, no blue color should appear.
	Limit of Moisture.	If 1 Gm. of the powdered salt be kept for twenty minutes at the temperature of 100° C. (212° F.), or slightly above it, it should not lose more than 0.03 Gm. in weight.
	More than 2.71 per cent. of Chloride.	If 0.3 Gm. of the well-dried salt be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should not require more than 29.8 C.c. of decinormal silver nitrate V.S. to produce a permanent red color.

Uses.—Sodium bromide is used for the same purposes as potassium bromide. It is probably inferior to the latter as a nervous sedative, although frequently combined with it. The dose is thirty to sixty grains (1.9 to 3.8 Gm.).

SODII CARBONAS. *U. S.* Sodium Carbonate.

$Na_2CO_3 + 10H_2O = 285.45.$

Preparation.—Impure sodium carbonate, or soda-ash, is consumed in enormous quantities in the arts, and cheap methods of production have been long sought for. The process elaborated by Leblanc in 1784,

a French apothecary, has been most largely used, and it possesses a historic interest because of the public endorsements which it received from the French government in 1794. It is remarkable that this process has been successfully worked, without material modifications, *for a century*, and has supplied the world with cheap soap and cheap glass. It also furnishes a striking illustration of the unrequited labors of inventors and benefactors, from the fact that Leblanc died a pauper in a French asylum. Sodium carbonate is made from common salt by two steps: first, by converting the salt by sulphuric acid into sodium sulphate, and, secondly, by decomposing the sulphate by calcium carbonate and charcoal at a high temperature, so as to yield sodium carbonate. The chemical reactions are as follows:

$$\underset{\text{Sodium Chloride.}}{2NaCl} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Hydrochloric Acid.}}{2HCl},$$

$$\underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Carbon.}}{C_4} = \underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Calcium Sulphide.}}{CaS} + \underset{\text{Carbon Monoxide.}}{4CO}.$$

The sulphate, first dried, is mixed with its own weight of ground limestone, and half its weight of small coal, ground and sifted, and the whole is heated in a reverberatory furnace, where it fuses and forms a black mass. The coal, at the temperature employed, converts the sodium sulphate into sodium sulphide. This reacts with the limestone, so as to form calcium sulphide and sodium carbonate. The black mass is next digested in warm water, which takes up the alkali and other soluble matters, and leaves the insoluble impurities, called *soda waste*, largely utilized in the manufacture of sodium hyposulphite. The solution is evaporated to dryness, and the mass obtained is calcined with one-fourth of its weight of sawdust, to convert the alkali fully into carbonate, by means of the carbonic acid resulting from the combustion of the sawdust. The product is redissolved in water, and the solution evaporated to dryness. This soda-ash contains about 50 per cent. of sodium carbonate.

Solvay's process for making sodium bicarbonate is given on page 559; the bicarbonate is easily converted into carbonate by heating, and the carbon dioxide is utilized in another part of the process.

The cryolite process is used largely in the United States. Cryolite, $Al_2F_6 + 6NaF$, consists mainly of a double fluoride of aluminium and sodium, containing in 100 parts 13 of aluminium, 34 of sodium, and 53 of fluorine. Sodium carbonate is obtained by heating cryolite with chalk, whereby calcium fluoride is formed, while the sodium and aluminium combine to form sodium aluminate, a weak salt, which is dissolved out by lixiviation. The soda is converted into carbonate by passing carbon dioxide under pressure through the solution; and the alumina, separated from the soda, becomes insoluble, and is deposited.

$$\underset{\text{Cryolite.}}{Al_2F_6} + 6NaF + \underset{\text{Calcium Carbonate.}}{6CaCO_3} = \underset{\text{Sodium Aluminate.}}{Al_2O_3,3Na_2O} + \underset{\text{Calcium Fluoride.}}{6CaF_2} + \underset{\text{Carbon Dioxide.}}{6CO_2}.$$

Very excellent sodium bicarbonate is now obtained from England and Germany, there being much competition among the manufacturers to produce the salt cheaply and of good quality.

Sodii Carbonas. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Colorless, monoclinic crystals, rapidly efflorescing in dry air, and, if exposed, soon loses about half of its water of crystallization (31.46 per cent. of its weight), and becomes a white powder. When heated to 32.5° C. (90.5° F.), the crystals fuse in their water of crystallization, and lose some water. At a higher temperature, the salt continues to lose water, until, at last, an anhydrous residue is left, corresponding to 37 per cent. of the weight of the crystals. At a bright red heat the anhydrous salt fuses. To a non-luminous flame it imparts an intensely yellow color.	Odorless; strongly alkaline taste; alkaline reaction, effervescing strongly with acids.	At 15° C. (59° F.), 1.6 parts. At 38° C. (100.4° F.), 0.09 part. Boiling, 0.2 part.	Insoluble.	Insoluble in ether. Soluble in 1.02 parts of glycerin.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
A 5-per-cent. aqueous solution of the salt should be perfectly clear and colorless, leaving no insoluble residue.	Sulphocyanate.	If 5 C.c. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the liquid should not be colored red by a drop of ferric chloride T.S.
If the crystallized salt be heated in a test-tube, the vapor of *ammonia* should not be evolved.	Arsenic, Lead, Iron, Aluminum, etc.	If to 5 C.c. of the aqueous solution, slightly supersaturated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, no turbidity should be produced either before or after the addition of ammonia water in slight excess.
To neutralize 1 Gm. of anhydrous Sodium Carbonate (deprived of its water of crystallization by heat immediately before being weighed) should require not less than 18.7 C.c. of normal sulphuric acid (corresponding to not less than 98.9 per cent. of the pure salt), methyl-orange being used as indicator.	Calcium.	If 5 C.c. of the aqueous solution be slightly supersaturated with acetic acid, the addition of 0.5 C.c. of ammonium oxalate T.S. should produce no turbidity.
	Limit of Potassium.	If 5 C.c. of the aqueous solution be slightly supersaturated with acetic acid, the addition of 0.5 C.c. of sodium cobaltic nitrite T.S. should not render it turbid within one hour.
	Limit of Chloride.	If 1.2 Gm. of the salt be dissolved in 10 C.c. of diluted nitric acid, then 0.5 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by further addition of silver nitrate V.S.
	Limit of Sulphate, Sulphite, and Hyposulphite.	If 2.5 Gm. of the salt be dissolved in 10 C.c. of diluted hydrochloric acid, then 0.1 C.c. of nitric acid and 0.1 C.c. of barium chloride T. S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.

Uses.—Sodium carbonate is one of the most useful of the alkaline salts: it is the source of most of the sodium salts made by the pharmacist. It is important in this connection not to use the effloresced carbonate, as it is stronger in proportion to the amount of water that it has lost. It is rarely given internally, on account of its disagreeable taste. The dose is from ten to twenty grains (0.6 to 1.2 Gm.).

SODII CARBONAS EXSICCATUS. *U.S.* **Dried Sodium Carbonate.**

	Metric.	Old form.
Sodium Carbonate	200 Gm.	32 oz. av.
To make	100 Gm.	16 oz. av.

Break the crystals into small fragments, and allow them to effloresce for several days in warm air, at a temperature not exceeding 25° C. (77° F.), until they are completely disintegrated; then dry the white powder at a temperature of about 45° C. (113° F.), until its weight is reduced to 100 Gm. [old form 16 oz. av.]. Pass the powder through a sieve, and preserve it in well-stoppered bottles.

The theoretical proportion of water in official sodium carbonate is nearly 63 per cent., so that the exsiccated carbonate still retains some water of crystallization. It is a white, hygroscopic powder, corresponding to the tests of purity under Sodii Carbonas. It is, of course, of twice the strength of sodium carbonate. To neutralize 1 Gm. of Dried Sodium Carbonate should require not less than 13.8 C.c. of normal sulphuric acid (corresponding to about 73 per cent. of anhydrous sodium carbonate).

Uses.—The object of driving off water from sodium carbonate is to furnish a more uniform product, and to render the dose, when administered in pill or powder form, less bulky. The dose is from five to ten grains (0.3 to 0.6 Gm.).

SODII CHLORAS. *U.S.* **Sodium Chlorate.**

$NaClO_3 = 106.25.$

Preparation.—This salt is usually prepared by Wittstein's process, which consists in first preparing acid sodium tartrate by adding a strong solution containing nine and a half parts of tartaric acid to a hot aqueous solution of nine parts of sodium carbonate. The hot solution is mixed with one in which eight parts of potassium chlorate have been dissolved. Acid potassium tartrate separates, whilst sodium chlorate remains in solution. The filtered solution is evaporated and crystallized. If desired of absolute purity, it may be recrystallized from an alcoholic solution.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Tartaric Acid.}}{2H_2C_4H_4O_6} = \underset{\text{Acid Sodium Tartrate.}}{2NaHC_4H_4O_6} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O},$$

$$\underset{\text{Acid Sodium Tartrate.}}{NaHC_4H_4O_6} + \underset{\text{Potassium Chlorate.}}{KClO_3} = \underset{\text{Sodium Chlorate.}}{NaClO_3} + \underset{\text{Acid Potassium Tartrate.}}{KHC_4H_4O_6}.$$

Owing to the facility with which this salt parts with its oxygen, the following official cautionary direction should be borne in mind: "Sodium Chlorate should be kept in glass-stoppered bottles, and *great caution* should be observed in handling the salt, as dangerous explosions are liable to occur when it is mixed with organic matters (cork, tannic acid, sugar, etc.), or with sulphur, antimony sulphide, phosphorus, or other easily oxidizable substances, and either heated directly, or subjected to trituration or concussion."

Sodii Chloras. U. S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless, transparent crystals (principally regular cubes with tetrahedral facets), or a crystalline powder, permanent in dry air. When heated, the salt melts and gives off oxygen (about 45 per cent. of its weight), finally leaving a residue of sodium chloride, readily soluble in water, and yielding, with silver nitrate T.S., a white, curdy precipitate, insoluble in nitric acid.	Odorless; cooling, saline taste; neutral reaction.	At 15° C. (59° F.), 1.1 parts. Boiling, 0.5 part.	At 15° C. (59° F.), 100 parts. Boiling, 40 parts.	Soluble in 5 parts of glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
It imparts to a non-luminous flame an intensely yellow color. When a crystal of the salt is dropped into hydrochloric acid, the liquid assumes a deep greenish-yellow color, and emits the odor of chlorine.	Limit of Potassium.	A saturated, aqueous solution should not be rendered turbid by sodium bitartrate T.S.
	Tartrate.	An aqueous solution of the residue left after igniting a portion of the salt should not give an alkaline reaction upon litmus paper.
	Arsenic, Lead, etc.	The aqueous solution (1 in 20), slightly acidulated with acetic acid, should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either at once,
	Iron, Aluminum, etc.	Or after the addition of ammonia water in slight excess.
	Magnesium, etc.	The aqueous solution (1 in 20) should not be rendered turbid by adding to it a few drops of ammonia water and then sodium phosphate T.S.
	Calcium.	The solution (1 in 20), slightly acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S.,
	Sulphate.	Nor by barium chloride T.S.
	Limit of Chloride.	Nor should silver nitrate T.S. produce in it more than a slight opalescence.

Uses.—This salt has an advantage over potassium chlorate in point of solubility, thus permitting the use of stronger solutions. The dose is from ten to twenty grains (0.6 to 1.2 Gm.).

SODII CHLORIDUM. *U. S.* Sodium Chloride.

$NaCl$; 58.37.

Preparation.—Common salt is universally distributed over the world, and may be mined, as rock salt, or obtained by evaporating sea-water.

Sodii Chloridum. U. S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless, transparent, cubical crystals, or a white, crystalline powder, permanent in dry air. When heated, the salt decrepitates; at a red heat it fuses, and at a still higher temperature it is slowly volatilized, with partial decomposition. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Odorless; purely saline taste; neutral reaction.	At 15° C. (59° F.), 2.8 parts. Boiling, 2.5 parts.	Almost insoluble.	Insoluble in ether or chloroform.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
With silver nitrate T.S. the solution yields a white, curdy precipitate insoluble in nitric acid. If 0.195 Gm. of well-dried Sodium Chloride be dissolved in 10 C.c. of water, and the solution mixed with a few drops of potassium chromate T.S., it should require not less than 33.4 C.c. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 99.9 per cent. of the pure salt).	Limit of Potassium.	No turbidity should be produced in 5 C.c. of the aqueous solution (1 in 20) by the addition of 0.5 C.c. of sodium cobaltic nitrite T.S.,
	Magnesium, etc.	Nor by the addition of sodium phosphate T.S. and a few drops of ammonia water.
	Calcium.	The aqueous solution, slightly acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S.,
	Sulphate.	Nor by barium chloride T.S.,
	Arsenic, Lead, Zinc, Iron, Aluminum, etc.	Nor by an equal volume of hydrogen sulphide T.S., either before or after addition of ammonia water in slight excess.
	Iodide or Bromide.	If 2 Gm. of the finely powdered salt be digested for some hours with 25 C.c. of warm alcohol, and, after cooling, the undissolved salt be removed by filtration, then the filtrate evaporated to dryness and the residue dissolved in 1 C.c. of water and mixed with a few drops of starch T.S., the addition of chlorine water, drop by drop, should produce neither a blue nor a yellow tint.

Uses.—Sodium chloride is largely used as a condiment and an antiseptic. It undoubtedly serves a useful purpose in the animal economy, as many animals possess an instinctive craving for it. Salt baths are tonic, and valuable aids in many diseases. Common salt is used as a styptic in hemorrhage.

SODII HYPOPHOSPHIS. *U. S.* Sodium Hypophosphite.

$$NaPH_2O_2 + H_2O = 105.84.$$

Preparation.—This salt is prepared by mixing a solution of six ounces of calcium hypophosphite in four pints of water with a solution of ten ounces of sodium carbonate in one and a half pints of water.

$$\underset{\substack{\text{Calcium}\\\text{Hypophosphite.}}}{Ca2H_2PO_2} + \underset{\substack{\text{Sodium}\\\text{Carbonate.}}}{Na_2CO_3} = \underset{\substack{\text{Sodium}\\\text{Hypophosphite.}}}{2NaH_2PO_2} + \underset{\substack{\text{Calcium}\\\text{Carbonate.}}}{CaCO_3}.$$

Double decomposition takes place, with the formation of calcium carbonate and sodium hypophosphite, of which the latter is held in solution, and the former precipitated. After filtration to separate the calcium carbonate, the solution is evaporated to a pellicle, and then stirred constantly till the salt granulates, the heat being continued. If required quite pure, the granulated salt is dissolved in officinal alcohol, and the liquid, having been evaporated to a syrupy consistence, is set aside to crystallize.

Sometimes the sodium hypophosphite explodes with violence during the evaporation of its solution. This was ascribed to the use of too high a heat; but the same accident has occurred when the heat was applied by means of a water-bath. Evaporation, therefore, should be performed below 100° C. (212° F.).

$$\underset{\substack{\text{Sodium}\\\text{Hypophosphite.}}}{5NaH_2PO_2} = \underset{\substack{\text{Sodium}\\\text{Pyrophosphate.}}}{Na_4P_2O_7} + \underset{\substack{\text{Sodium}\\\text{Metaphosphate.}}}{NaPO_3} + \underset{\substack{\text{Phosphoretted}\\\text{Hydrogen.}}}{2PH_3} + \underset{\text{Hydrogen.}}{2H_2}.$$

The gases evolved by heat are hydrogen and hydrogen phosphide. The latter is well known to be spontaneously inflammable.

The acid present in this salt is *hypophosphorous acid.* It consists of one atom of phosphorus, two atoms of oxygen, and three atoms of hydrogen, only one of the latter being replaceable by a metal.

This acid is a powerful deoxidizer: as it reduces mercury and silver from their combinations, it should not be prescribed with either. The solubility of sodium hypophosphite and of other hypophosphites is increased by the addition of hypophosphorous acid. (See p. 305.)

Sodii Hypophosphis. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Small, colorless, transparent, rectangular plates of a pearly lustre, or a white granular powder, very deliquescent on exposure to air. When heated in a test-tube, the salt at first loses its water of crystallization, and at about 200° C. (392° F.) it is decomposed, evolving hydrogen and hydrogen phosphide, which burn with a bright yellow flame, and leaving a residue of sodium pyrophosphate and metaphosphate, sometimes mingled with a little red phosphorus. To a non-luminous flame the salt communicates an intensely yellow color.	Odorless; bitterish, sweet, saline taste; neutral reaction.	At 15° C. (59° F.), 1 part. Boiling, 0.12 part.	At 15° C. (59° F.), 30 parts. Boiling, 1 part.	Slightly soluble in absolute alcohol. Insoluble in ether.

Tests for Identity.	Impurities.	Tests for Impurities.
On triturating or heating Sodium Hypophosphite with nitrates, chlorates, or other oxidizing agents, it detonates violently.	Limit of Potassium.	A solution of 0.5 Gm. of the salt in 1 C.c. of water should yield no precipitate upon the addition of 1 C.c. of sodium bitartrate T.S.
A 5-per-cent aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate, which rapidly turns brown or black, owing to the separation of metallic silver.	Caustic Alkali or Carbonate.	The aqueous solution (1 in 20) should not be colored red by the addition of a drop of phenolphtalein T.S., nor effervesce on the addition of an acid.
	Calcium.	Nor should it be rendered turbid by ammonium oxalate T.S.
When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added in small quantity to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed. On further addition of the solution, the precipitate is reduced to metallic mercury.	Arsenic, Lead, etc.	In the aqueous solution (1 in 20), acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. should not produce any turbidity.
	Chloride.	After heating 10 C.c. of the aqueous solution (1 in 20) with 1 C.c. of nitric acid, separate portions of the solution should remain clear upon the addition of silver nitrate T.S.
	Sulphate.	And of barium chloride T.S.
If 0.1 Gm. of dry Sodium Hypophosphite be dissolved in 10 C.c. of water, mixed with 7.5 C.c. of sulphuric acid and 40 C.c. of decinormal potassium permanganate V.S., and the mixture boiled for fifteen minutes, it should require not more than 3 C.c. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 97.96 per cent. of the pure salt).	Limit of Phosphate.	Not more than a slight cloudiness should be produced in the aqueous solution of the salt by magnesia mixture.
	Iron.	Potassium ferrocyanide T.S. should not produce in the acidulated solution any blue color.

Uses.—Sodium hypophosphite is used in exhausted conditions of the nervous system; in pharmacy, solely as an ingredient in syrup of the hypophosphites.

SODII HYPOSULPHIS. *U. S.* Sodium Hyposulphite.

$Na_2S_2O_3 + 5H_2O$; 247.64.

Preparation.—Sodium hyposulphite, or, more correctly, *sodium thiosulphate*, is made by decomposing soluble calcium thiosulphate, obtained by the oxidation of alkali waste, with either sodium sulphate or sodium carbonate.

$$\underset{\text{Calcium Thiosulphate.}}{CaS_2O_3} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4} = \underset{\text{Sodium Thiosulphate.}}{Na_2S_2O_3} + \underset{\text{Calcium Sulphate.}}{CaSO_4}.$$

Other methods of making "hyposulphite of soda" have been used, but the above process has superseded them because of its economy. It is now made on a very large scale.

Sodii Hyposulphis. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless, transparent, monoclinic prisms. Permanent in the air below 33° C. (91.4° F.), but efflorescent in dry air above that temperature. When rapidly heated to about 50° C. (122° F.), the salt melts; when slowly heated until it is effloresced, and afterwards to 100° C. (212° F.), it loses all its water (36.3 per cent.), and at a low red heat it is decomposed, sulphur being evolved, while a residue of sodium sulphide and sulphate remains. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Odorless; cooling, somewhat bitter taste; neutral reaction.	At 15° C. (59° F.), 0.65 part. At 20° C. (68° F.), 0.5 part. Boiling, Rapidly decomposed.	Insoluble.	Slightly soluble in oil of turpentine.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
An aqueous solution of the salt readily dissolves many salts of silver (chloride, bromide, iodide, oxide, etc.), and discharges the color of a solution of iodine or of starch iodide.	Lead, Iron, etc.	If to 5 C.c. of the aqueous solution (1 in 20) an equal volume of hydrogen sulphide T.S. be added, no coloration or turbidity should be perceptible either before or after the addition of 1 C.c. of ammonia water.
If ferric chloride T.S. be dropped into the aqueous solution (1 in 20), a dark violet color will be produced, which disappears rapidly on agitation.	Calcium.	The aqueous solution should not be rendered turbid by the addition of ammonium oxalate T.S.
Addition of sulphuric or hydrochloric acid to the aqueous solution liberates from it sulphur dioxide (known by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. and held in the escaping gas), and causes a white precipitate of sulphur (distinction from *sulphite* or *bisulphite*).	Caustic Alkali or Carbonate.	The aqueous solution of the salt (1 in 20) should not be colored red by a drop of phenolphtalein T.S.
If 0.25 Gm. of Sodium Hyposulphite be dissolved in 10 C.c. of water and a few drops of starch T.S. added, it should require at least 9.9 C.c. of decinormal iodine V.S. to produce a permanent blue color (corresponding to at least 98.1 per cent. of the pure salt).	Sulphide.	Nor should a drop of silver nitrate T.S. produce a brown or a black precipitate in 5 C.c. of this solution.
	Sulphate.	In a dilute aqueous solution (1 in 80), barium chloride T.S. should produce no turbidity.

Uses.—This compound is used in the official volumetric test of sodium hyposulphite, and occasionally in medicine, as an alterative and resolvent, in doses of ten to thirty grains (0.6 to 1.9 Gm.). Externally, it is used in baths, and also as an ointment. Its principal use is in the arts, as an *antichlor* in paper manufacture; whilst in photography, under the abbreviated name of "hypo," it is invaluable as a solvent for the unaltered silver chloride or bromide in the film.

SODII IODIDUM. *U. S.* Sodium Iodide.

NaI; 149.53.

Preparation.—This iodide may be prepared by double decomposition between solutions of ferrous iodide and sodium carbonate, or by treating a solution of sodium hydrate with iodine, exactly as in the preparation of potassium iodide. The former process is preferable if working on a small scale.

$$\underset{\text{Ferrous Iodide.}}{FeI_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Iodide.}}{2NaI} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

By boiling the solution containing the ferrous carbonate the latter is rendered less bulky, and it can be easily separated by filtration.

Sodii Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, cubical crystals, or a white, crystalline powder. In moist air it deliquesces and becomes partially decomposed into sodium carbonate and free iodine, assuming, thereby, a reddish color. At a dull red heat the salt melts. At a full red heat it is slowly volatilized, with partial decomposition. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Odorless; saline and slightly bitter taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.33 part.	At 15° C. (59° F.), 3 parts. Boiling, 1.4 parts.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If to 5 C.c. of the aqueous solution (1 in 20) 1 C.c. of chlorine water be added, iodine will be liberated and impart to the solution a yellow color. On agitating this mixture with a few drops of chloroform, the latter will acquire a violet color.	More than 5 per cent. of Water.	If the salt be in distinct crystals, only a few monoclinic prisms (containing 2 molecules of water) should be found among the regular cubes of the anhydrous salt. On drying 1 Gm. of the salt at 100° C. (212° F.), it should not lose more than 0.05 Gm. in weight.
	Limit of Potassium.	A solution of 1 Gm. of the salt in 1 C.c. of water should yield no precipitate with 1 C.c. of sodium bitartrate T.S.
	Calcium.	The aqueous solution (1 in 20), slightly acidulated with acetic acid, should remain clear after the addition of ammonium oxalate T.S.
	Arsenic, etc.	Or of an equal volume of hydrogen sulphide T.S.
	Zinc, Iron, Aluminum, etc.	The addition of ammonium sulphide T.S. should not produce either a coloration or a turbidity in the aqueous solution.
	Limit of Alkali.	If 1 Gm. of the salt be dissolved in water, and 0.05 C.c. (1 drop) of decinormal oxalic acid V.S. be added, no red color should be produced by the addition of a drop of phenolphtalein T.S.
	Iron.	The aqueous solution, slightly acidulated with hydrochloric acid, should not be colored blue upon the addition of potassium ferrocyanide T.S.

TESTS.—*Continued.*

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If 0.5 Gm. of the well-dried salt be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should not require more than 34.5 C.c. nor less than 33.4 C.c. of decinormal silver nitrate V.S. to produce a permanent red color, corresponding to at least 98 per cent, of the pure salt.	Free Iodine.	If 0.5 Gm. of the salt be dissolved in 10 C.c. of freshly boiled distilled water, and the solution mixed with a few drops of starch T.S., no blue color should appear either at once
	Iodate.	Or after the addition of a drop of diluted hydrochloric acid.
	Sulphate.	If 5 C.c. of the aqueous solution (1 in 20) be acidulated with hydrochloric acid, and 0.5 C.c. of barium chloride T.S. be added, no immediate turbidity should appear.
	Cyanide.	If 5 C.c. of the aqueous solution be gently heated with 1 drop of ferrous sulphate T.S. and 0.5 C.c. of potassium hydrate T.S., no blue color should appear after acidulating the mixture with hydrochloric acid.
	Nitrate or Nitrite.	If 1 Gm. of the salt be mixed with 0.5 Gm. of iron filings and 0.5 Gm. of powdered zinc, and heated in a test-tube with 5 C.c. of sodium hydrate T.S., no ammoniacal vapors should be evolved.

Uses.—Medicinally, this salt is preferred to potassium iodide by some practitioners, although apparently without good reasons. The dose is from five to fifteen grains (0.3 to 0.9 Gm.).

SODII NITRAS. *U. S.* Sodium Nitrate.

$NaNO_3$; 84.89.

Preparation.—Sodium nitrate, called also *cubic nitre*, and *Chili saltpetre*, is a native salt found in Chili and Peru, purified by crystallization from its aqueous solution. It is the cheapest source for obtaining nitrates, as explained elsewhere (see Acidum Nitricum).

Sodii Nitras. *U S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, transparent, rhombohedral crystals. Deliquescent in damp air. When heated to about 312° C. (593.6° F.), the salt melts without decomposition. At a higher temperature it evolves oxygen and is reduced to nitrite.	Odorless; cooling, saline, and slightly bitter taste; neutral reaction.	At 15° C. (59° F.), 1.3 parts. Boiling, 0.6 part.	At 15° C. (59° F.), 100 parts. Boiling, 40 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Thrown upon red-hot coals, the salt deflagrates. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Limit of Potassium.	A solution of 0.5 Gm. of the salt in 1 C.c. of water should not be precipitated or rendered turbid by 1 C.c. of sodium bitartrate T.S.
If the aqueous solution be mixed in a test-tube with a drop of diphenylamine T.S., and sulphuric acid be carefully poured in, so as to form a separate layer, a deep blue color will appear at the line of contact.	Arsenic and Metallic Impurities.	The aqueous solution (1 in 20) should not be colored or rendered turbid by the addition of hydrogen sulphide T.S. or ammonium sulphide T.S.
	Calcium, Magnesium, etc.	Nor by the addition of equal parts of ammonia water and sodium phosphate T.S.
	Iodate and Iodide.	If the aqueous solution be mixed with a few drops, each, of hydrogen sulphide T.S. and starch T.S., and then some chlorine water poured carefully upon the mixture, no blue color should appear at the line of contact.
	Sulphate.	No turbidity should be produced within five minutes in the aqueous solution, acidulated with nitric acid, on the addition of barium chloride T.S.
	Chloride.	Or silver nitrate T.S.

Uses.—Sodium nitrate is used in a number of diseases, such as epilepsy, angina pectoris, dysentery, etc., but without marked effects. The dose is fifteen to twenty grains (0.9 to 1.2 Gm.).

SODII NITRIS. *U. S.* Sodium Nitrite.

$NaNO_2 = 68.93$.

Preparation.—Sodium nitrite has been made official solely on account of its use in preparing spirit of nitrous ether. It is made by heating sodium nitrate in contact with starch, or preferably by adding strips of sheet-lead to sodium nitrate heated to the fusing point for several hours, lead oxide being formed at the same time. After cooling, the fused sodium nitrite is lixiviated with water, purified, and recrystallized.

Sodii Nitris. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
White, opaque, fused masses, usually in the form of pencils, or colorless, transparent, hexagonal crystals. When exposed to the air, the salt deliquesces and is gradually oxidized to sodium nitrate. When heated, the salt melts, and at a red heat it is decomposed, yielding oxygen, nitrogen, nitrogen dioxide, and sodium oxide. To a non-luminous flame it imparts an intensely yellow color.	Odorless; mild, saline taste; alkaline reaction.	At 15° C. (59° F.), 1.5 parts. Boiling, Very soluble.	Slightly soluble.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
If the aqueous solution of the salt be mixed with some potassium iodide T.S., and a few drops of acid added, iodine will be liberated, and nitrogen dioxide gas will escape with effervescence. If 0.15 Gm. of Sodium Nitrite be dissolved in 5 C.c. of water, and introduced into a nitrometer, then followed by a solution of 1 Gm. of potassium iodide in 6 C.c. of water and 15 C.c. of normal sulphuric acid, the liberated nitrogen dioxide gas should measure not less than 50 C.c. at 15° C. (59° F.), or 51.7 C.c. at 25° C. (77° F.), corresponding to not less than 97.6 per cent. of the pure salt.	Insoluble Impurities.	The salt should readily dissolve in 20 parts of water, forming a colorless solution, leaving no insoluble residue.
	Iodide.	If 1 drop of hydrochloric acid and a few drops of starch T.S. be added to 5 C.c. of the aqueous solution, no blue coloration should appear.
	Lead, Arsenic, Copper, etc.	If 5 C.c. of the aqueous solution be mixed with an equal volume of hydrogen sulphide T.S., no coloration or precipitate should be produced.

SODII PHOSPHAS. *U. S.* Sodium Phosphate.

$Na_2HPO_4 + 12H_2O = 357.82$.

[Sodium Orthophosphate.]

Preparation.—Sodium phosphate may be prepared by the process formerly official, as follows:

Take of Bone, calcined to whiteness and in fine powder, 120 oz. troy; Sulphuric Acid 72 oz. troy; Carbonate of Sodium, Water, each, a sufficient quantity. Mix the powder with the Sulphuric Acid in

an earthen vessel; then add 8 pints of Water, and, having stirred the mixture thoroughly, digest for three days, occasionally adding a little Water to replace that which is lost by evaporation, and frequently stirring the mixture. At the expiration of that time, pour in 8 pints of boiling Water, and strain through muslin, gradually adding more boiling Water until the liquid passes nearly tasteless. Set by the strained liquor that the dregs may subside, and, having poured off the clear solution, boil it down to 8 pints. To the concentrated liquid, poured off from the newly formed dregs and heated in an iron vessel, add by degrees Carbonate of Sodium, previously dissolved in hot Water, until effervescence ceases, and the phosphoric acid is completely saturated; then filter the liquid, and set it aside to crystallize. Having removed the crystals, add, if necessary, a small quantity of Carbonate of Sodium to the liquid, so as to render it slightly alkaline; then alternately evaporate and crystallize, so long as crystals are produced. Lastly, keep the crystals in a well-stopped bottle.

The part of bones which is incombustible is obtained by burning them to whiteness, and consists of neutral calcium phosphate, called *bone-phosphate*, or *bone-ash*, associated with some calcium carbonate. When this is mixed with sulphuric acid, the calcium carbonate is entirely decomposed, giving rise to effervescence. The calcium phosphate undergoes partial decomposition; the greater part of the lime, being liberated, precipitates as calcium sulphate, while the phosphoric acid combines with the undecomposed portion of the phosphate, and remains in solution as an acid calcium phosphate, holding dissolved a small portion of calcium sulphate.

$$\underset{\text{Calcium Phosphate.}}{Ca_3 2PO_4} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Acid Calcium Phosphate.}}{CaH_4 2PO_4} + \underset{\text{Calcium Sulphate.}}{2CaSO_4}.$$

In order to separate the acid phosphate from the precipitated mass of calcium sulphate, boiling water is added to the mixture, the whole is strained, and the sulphate washed as long as acid phosphate is removed, which is known by the water passing through in an acid state. The different liquids which have passed the strainer, consisting of the solution of acid calcium phosphate, are mixed and allowed to stand; and by cooling a portion of calcium sulphate is deposited, which is got rid of by decantation. The bulk of the liquid is now reduced by evaporation, and, in consequence of the diminution of the water, a fresh portion of calcium sulphate is deposited, which is separated by subsidence and decantation as before. The acid calcium phosphate solution, being heated, is now saturated by means of a hot solution of sodium carbonate. The carbonic acid is liberated with effervescence, and the alkali, combining with the excess of acid of the acid phosphate, produces sodium phosphate; while the acid calcium phosphate, by the loss of its excess of acid, becomes the neutral phosphate and precipitates.

$$\underset{\text{Acid Calcium Phosphate.}}{CaH_4 2PO_4} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Calcium Phosphate.}}{CaHPO_4} + \underset{\text{Sodium Phosphate.}}{Na_2HPO_4} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The calcium phosphate is separated by filtration; and the filtered liquor, which is a solution of sodium phosphate, is evaporated so as to crystallize.

Sodii Phosphas. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Large, colorless, monoclinic prisms. The crystals effloresce in the air, and gradually lose 5 molecules of their water of crystallization (25.1 per cent.). When heated to about 40° C. (104° F.), the salt fuses, yielding a clear liquid, and, on continued heating to near 100° C. (212° F.), it loses all its water of crystallization (60.3 per cent.). At a red heat, it is converted into sodium pyrophosphate.	Odorless; cooling, saline taste; slightly alkaline reaction.	At 15° C. (59° F.), 5.8 parts. Boiling, 1.5 parts.	Insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
A fragment of the salt imparts to a non-luminous flame an intensely yellow color. A 5-per-cent. aqueous solution of the salt yields a white precipitate with magnesia mixture. With silver nitrate T.S. it yields a yellow precipitate, soluble in ammonia water and in nitric acid. If 0.5 C.c. of the aqueous solution be mixed with 1 C.c. of ammonium molybdate T.S., the mixture will at once assume a yellow color, and, after a few minutes, yield a yellow precipitate, the appearance of which is hastened by a gentle heat.	Calcium.	No residue should be left on dissolving the salt in water.
	Metals.	No turbidity or coloration should be produced in the aqueous solution by the addition of a small quantity of ammonium sulphide T.S., or of an equal volume of hydrogen sulphide T.S. after the addition of a few drops of hydrochloric acid.
	Limit of Arsenic.	If 1 Gm. of the powdered salt be shaken with 3 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), then a small piece of pure tin-foil added, and a gentle heat applied, no brown coloration should appear within fifteen minutes.
	Limit of Potassium.	If 0.5 Gm. of the salt be dissolved in 4 C.c. of water, and 1 C.c. of sodium bitartrate then added, the solution should remain perfectly clear.
	Carbonate.	No effervescence should occur on the addition of hydrochloric or nitric acid to a solution of the salt.
	Hypophosphite, etc.	On adding to 5 C.c. of the aqueous solution (1 in 20) 0.5 C.c. of silver nitrate T.S., a pure yellow precipitate will be formed, which should not become dark-colored by heating,
	Limit of Chloride.	And which, upon the addition of nitric acid, should yield a perfectly clear or, at most, only a slightly opalescent liquid.
	Limit of Sulphate.	If to 5 C.c. of the aqueous solution, acidulated with hydrochloric acid, 0.5 C.c. of barium chloride T.S. be added, the solution should not be rendered more than very slightly opalescent.

Uses.—Sodium phosphate is principally used as a cathartic, in doses of half an ounce to one ounce (15.5 to 31.1 Gm.).

SODII PYROPHOSPHAS. *U.S.* Sodium Pyrophosphate.

$$Na_4P_2O_7 + 10H_2O = 445.24.$$

Preparation.—Sodium pyrophosphate, as its name indicates, is prepared by heating sodium phosphate in a suitable vessel to redness. When sodium phosphate is subjected to a temperature of 44° C. (111.2° F.), it melts in its water of crystallization; if the heat be increased to 100° C. (212° F.), all the water is dispelled, and but 40 per

cent. of the original weight remains; at 300° C. (572° F.) it is converted into the tetrabasic phosphate or pyrophosphate. By dissolving this residue in water, filtering, and crystallizing, the salt may be obtained.

Sodii Pyrophosphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, monoclinic prisms, or a crystalline powder, permanent in cool air, slightly efflorescent in warm air. When heated to 100° C. (212° F.), the salt loses its water of crystallization (40.34 per cent.) without previous fusion. At a higher temperature it fuses, forming a transparent liquid, which, on cooling, solidifies to a crystalline mass.	Odorless; cooling, saline, and feebly alkaline taste; slightly alkaline reaction.	At 15° C. (59° F.), 12 parts. Boiling, 1.1 parts.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
A fragment of the salt imparts to a non-luminous flame an intensely yellow color. A 5-per-cent. aqueous solution of the salt yields with magnesia mixture a white precipitate; with silver nitrate T.S. it yields a precipitate of a pure white color (distinction from *orthophosphate*). Soluble in ammonia water and in nitric acid. With ammonium molybdate T.S. no precipitate is formed within 15 or 20 minutes, even when a gentle heat is applied (distinction from *orthophosphate*).	Metallic substances.	No turbidity or coloration should be produced in the aqueous solution (1 in 20) by the addition of a small quantity of ammonium sulphide T.S.; or of an equal volume of hydrogen sulphide T.S. after the addition of a few drops of hydrochloric acid.
	Limit of Arsenic.	If 1 Gm. of the powdered salt be shaken with 3 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), then a small piece of pure tin-foil added, and a gentle heat applied, no brown coloration should appear within fifteen minutes.
	Limit of Potassium.	If 0.5 Gm. of the salt be dissolved in 6 C.c. of water, and 1 C.c. of sodium bitartrate then added, the solution should remain perfectly clear.
	Carbonate.	No effervescence should occur on the addition of hydrochloric or nitric acid to a solution of the salt.
	Chloride.	In the aqueous solution of the salt, rendered acid by nitric acid, not more than a very slight opalescence should be produced by silver nitrate T.S.,
	Sulphate.	Or by barium chloride T.S.

Uses.—This salt was made official solely because of its use in preparing ferric pyrophosphate.

SODII SALICYLAS. *U. S.* Sodium Salicylate.

$NaC_7H_5O_3 = 159.67.$

Preparation.—Sodium salicylate is prepared by mixing one hundred parts of pure salicylic acid with sufficient distilled water to form a paste, and then with one hundred and four parts of pure crystallized carbonate of sodium (uneffloresced) in a glass or porcelain vessel; carbon dioxide will be evolved, and sodium salicylate will remain in solution.

$$\underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Sodium Salicylate.}}{2NaC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The liquid may be strained through thoroughly-washed muslin if found necessary, and heated in a capsule until the carbon dioxide is expelled.

It should not be filtered through ordinary paper, on account of the impurities generally present; the slightest contact with iron will discolor

the product, and for this reason the commercial sodium carbonate is unfitted for use in making this salt.

If alkaline to litmus paper, enough salicylic acid must be added to be slightly in excess, and the solution should be evaporated at a low heat to dryness. If the acid is not in excess, the salt will not be white, but gray or lead-colored; and if heated too much, the odor of carbolic acid will be noticed.

Sodii Salicylas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
A white, amorphous powder, permanent in cool air. When heated, the salt is decomposed, giving off inflammable vapors and an odor of phenol, and finally leaves a residue of sodium carbonate. To a non-luminous flame it imparts an intensely yellow color.	Odorless; sweetish, saline taste; feebly acid reaction.	At 15° C. (59° F.), 0.9 part. Boiling, Very soluble.	At 15° C. (59° F.), 6 parts. Boiling, Very soluble.	Soluble in glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
Ferric chloride T.S., added to an excess of a concentrated solution of the salt, produces a red precipitate; but when added to a very dilute solution (1 in 100), it produces a deep violet-blue color. If copper sulphate T.S. be added to the aqueous solution (1 in 20), a green color will be produced. On adding to a small portion of the salt, in a test-tube, about 1 C.c. of concentrated sulphuric acid, and then, cautiously, about 1 C.c. of methylic alcohol in drops, on heating the mixture to boiling, the odor of methyl salicylate will be evolved. Hydrochloric or sulphuric acid produces in a concentrated aqueous solution of the salt a voluminous, white precipitate, which, after being separated by filtration and washed, should conform to the reaction and tests given under Acidum Salicylicum.	Carbonate.	The aqueous solution should be colorless, even when concentrated, and should not effervesce on the addition of acids.
	Metallic substances.	When the solution (1 in 20) is mixed with a small quantity of ammonium sulphide T.S., or with an equal volume of hydrogen sulphide T.S., no coloration or turbidity should appear.
	Sulphate.	If 1 Gm. of the salt be dissolved in a mixture of 50 C.c. of alcohol and 25 C.c. of water, then acidulated with nitric acid and filtered, a portion of the filtrate should not be rendered turbid by the addition of a few drops of barium chloride T.S.
	Chloride.	Another portion of the filtrate should remain clear on the addition of a few drops of silver nitrate T.S.
	Readily Carbonizable Organic Impurities.	If 1 part of the salt be agitated with 15 parts of cold, concentrated sulphuric acid, no brown color should be produced within fifteen minutes.

Uses.—This salt is administered in rheumatic and neuralgic affections, in doses of twenty to thirty grains (1.3 to 1.9 Gm.).

SODII SULPHAS. *U. S.* Sodium Sulphate.

$Na_2SO_4 + 10H_2O = 321.42.$

[Glauber's Salt.]

Preparation.—This salt is largely obtained as a by-product in the manufacture of soda-ash, hydrochloric and nitric acids, ammonium chloride, etc.

Sodii Sulphas. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvent.
Large, colorless, transparent, monoclinic prisms, or granular crystals, rapidly efflorescing on exposure to air, and ultimately falling into a white powder. When heated to 33° C. (91.4° F.), the salt melts, and, on further heating, gradually loses all its water (55.9 per cent.). At a red heat the anhydrous salt melts without decomposition.	Odorless; saline and somewhat bitter taste; neutral reaction.	At 15° C. (59° F.), 2.8 parts. The solubility in water increases up to 34° C. (93.2° F.), when its maximum is attained, 1 part of the salt then dissolving in somewhat less than 0.25 part of water; from thence it gradually decreases with rising temperature, until 1 part requires 0.47 part of boiling water for solution.	Insoluble.	Soluble in glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
A fragment of the salt imparts to a non-luminous flame an intensely yellow color. The aqueous solution yields, with barium chloride T.S., a white precipitate insoluble in nitric acid.	Magnesium.	If to 5 C.c. of the aqueous solution (1 in 20) 1 C.c. of sodium phosphate T.S. and 0.5 C.c. of ammonia water be added, no turbidity or precipitate should be produced, even after agitation.
	Carbonate.	The solution should not effervesce on the addition of an acid.
	Arsenic and Metallic Impurities.	It should not be colored or rendered turbid by the addition of ammonium sulphide T.S.; or of an equal volume of hydrogen sulphide T.S., after being acidulated with hydrochloric acid.
	Chloride.	After acidulation with nitric acid, the aqueous solution should remain clear, or at most be rendered only very slightly opalescent, on the addition of silver nitrate T.S.

Care must be employed, in using the formulas requiring this salt, to see that it is not effloresced, as such a salt may have lost half of its water of crystallization, and be therefore one-third stronger than it should be.

Uses.—This well-known sulphate is largely used in veterinary practice. As a purgative it is not so well suited for administration to human beings, the magnesium sulphate being preferred. It may be given to adults in doses of half an ounce to one ounce (15.5 to 31.1 Gm.).

SODII SULPHIS. *U. S.* Sodium Sulphite.

$$Na_2SO_3 + 7H_2O = 251.58.$$

Preparation.—A very satisfactory mode of making this sulphite is by dissolving a convenient weight of sodium carbonate in a small quantity of water, then passing sulphurous acid gas through the solution until it is completely saturated and acid sodium sulphite is formed. The addition of an equal weight of sodium carbonate forms a solution of the neutral sulphite, which is to be evaporated and crystallized.

$$\underset{\text{Sodium Carbonate.}}{Na_2CO_3} + \underset{\text{Sulphurous Acid.}}{SO_2} = \underset{\text{Sodium Sulphite.}}{Na_2SO_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

The sodium sulphite which is most frequently used now is the *granulated sodium sulphite:* this is prepared by evaporating a solution of the sulphite to dryness in the usual manner. As thus prepared, it is much more stable than the crystallized salt: it should be remembered, however, that it is of nearly twice the strength of the latter, and the quantity used should be proportionally lessened. Theoretically, the quantity of water present in the crystals is exactly half their weight.

Sodii Sulphis. U. S.	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, monoclinic prisms, efflorescent in dry air, and is slowly oxidized to sulphate. When gently heated, the salt softens somewhat, but does not fuse. Above 100° C. (212° F.), the crystals lose all their water (50 per cent.), without fusing or changing their shape. At a red heat the salt fuses to a reddish-yellow mass of sodium sulphate and sodium sulphide. A fragment of the salt imparts to a non-luminous flame an intensely yellow color.	Odorless; cooling, saline and sulphurous taste; neutral or feebly alkaline reaction.	At 15° C. (59° F.), 4 parts. Boiling, 0.9 part.	Sparingly soluble.

Test for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Upon the addition of hydrochloric acid to the salt or its solution, sulphur dioxide gas is liberated, which is recognized by its odor and by its blackening a strip of paper moistened with mercurous nitrate T.S. and held in the escaping gas; the solution remains clear, no sulphur being separated (distinction from *hyposulphite*). If 0.63 Gm. of the salt be dissolved in 25 C.c. of water recently boiled to expel air, and a little starch T.S. be added, at least 48 C.c. of decinormal iodine V.S. should be required to produce a permanent blue tint (each C.c. corresponding to 2 per cent. of the pure salt).	Metallic Impurities.	The aqueous solution (1 in 20) should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either before or after the addition of ammonia water in slight excess.
	Limit of Sulphate.	If a solution of 2.5 Gm. of the salt in 11 C.c. of diluted hydrochloric acid be heated sufficiently to expel the sulphur dioxide, then 0.15 C.c. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S.
	Limit of Chloride.	If 1.2 Gm. of Sodium Sulphite be dissolved in 10 C.c. of diluted nitric acid, the solution heated to expel the gases, then 0.4 C.c. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unchanged by the further addition of silver nitrate V.S.

Uses.—Sodium sulphite is one of the most useful antiferments. It is given in doses of ten to thirty grains (0.6 to 1.9 Gm.).

SODII SULPHOCARBOLAS. *U. S.* Sodium Sulphocarbolate.

$$NaSO_3C_6H_4(OH) + 2H_2O = 231.56.$$

[Sodium Paraphenolsulphonate.]

Preparation.—Sodium sulphocarbolate may be made by mixing equal parts of pure carbolic acid and strong sulphuric acid, whereby *sulphocarbolic acid*, $C_6H_5HSO_4$, is produced. The mixed liquids must be subjected to a temperature of 55° C. (131° F.) for several days, and then twenty parts of water should be added. Two parts of barium

carbonate are mixed with the liquid, a little at a time, carefully graduating the quantity until effervescence ceases. The liquid is now allowed to stand, to permit the precipitation of the barium sulphate, and of any carbonate which may be present, and the liquor filtered. The solution of *barium sulphocarbolate* is decomposed by adding sodium carbonate until precipitation ceases, when the liquid is filtered from the barium carbonate, and the sodium sulphocarbolate may be obtained by evaporating the filtrate and crystallizing.

$$\underset{\text{Carbolic Acid.}}{C_6H_5HO} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Sulphocarbolic Acid.}}{HC_6H_5SO_4} + \underset{\text{Water.}}{H_2O.}$$

Sodii Sulphocarbolas. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, rhombic prisms, slightly efflorescent in dry air. When heated a little above 100° C. (212° F.), the salt loses all its water (15.5 per cent.) and becomes white. At a higher temperature it chars, emits inflammable vapors having the odor of phenol, and finally leaves a residue of sodium sulphate amounting to 30.6 per cent. of the original weight.	Odorless, or nearly so; cooling, saline, somewhat bitter taste; neutral reaction.	At 15° C. (59° F.), 4.8 parts. Boiling, 0.7 part.	At 15° C. (59° F.), 132 parts. Boiling, 10 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
A fragment of the salt imparts an intensely yellow color to a non-luminous flame. A dilute solution (1 in 100) of the salt is rendered pale violet by ferric chloride T.S., but remains clear; barium chloride T.S. leaves the solution clear; but if a portion of the salt be ignited, and the residue dissolved in water, the same reagent will produce in the solution a copious white precipitate.	Metallic Impurities.	In the aqueous solution (1 in 20) neither hydrogen sulphide T.S. nor ammonium sulphide T.S. should produce any turbidity or coloration.
	Sulphate.	Nor should more than a faint opalescence be produced by barium chloride T.S.
	Chloride.	Or by silver nitrate T.S.

Uses.—This salt is used as an antiferment, in doses of ten to twenty grains (0.6 to 1.3 Gm.). It is also used in injections.

QUESTIONS ON CHAPTER XXXIX.

THE SODIUM SALTS.

Why are sodium salts more frequently used than potassium salts?
Describe sodium.
How may sodium be recognized in its salts?
Table of preparations of sodium.
Soda—Give the formula in symbols and molecular weight.
How is it obtained?
Give rationale of process and chemical reaction; odor, taste, and tests for identity.
How may the following impurities be detected?—viz.: Organic matter; chloride; sulphate; carbonate; silica or carbonate.

Why is caustic soda preferred to potassa?
How is it used pharmaceutically?
Solution of soda—Give the Latin official name. How is it made?
How much hydrate of sodium does it contain?
What is the alternative process for making it?
Of what strength should the soda used in this process be; and if not of the proper strength, how can it be used?
How is sodium hydrate obtained? Give rationale of process; chemical reaction; description and specific gravity; odor, taste, and tests for identity.
How may the following impurities be detected?—viz.: Carbonate; alkaline earths; sulphate; chloride; foreign impurities.
What is the dose?
Sodium acetate—Give formula in symbols and molecular weight.
How is it obtained? How much water does it contain?
Give rationale of process and chemical reaction.
Describe the odor and taste. Give the tests for identity.
How may the following impurities be detected?—viz.: Chloride; sulphate; silica; metals; alkaline earths; carbonate; organic impurities.
What is the dose?
Sodium arsenate—Give formula in symbols and molecular weight.
Give the process for making it which was formerly official. Give rationale of process.
How much water does it contain? Give chemical reaction. How may impurity of arsenite be detected?
What is the dose?
Sodium benzoate—Give formula in symbols and molecular weight.
How is it made? Give rationale of process and chemical reaction.
Sodium bicarbonate—Give formula in symbols and molecular weight.
How is this prepared?
What is the object of washing the commercial bicarbonate?
How much of its weight does it lose on being heated?
What percentage of pure sodium bicarbonate is required in the official preparation?
Give rationale of process.
What chemical reaction takes place during the process?
How may the following impurities be detected?—viz.: Chloride; sulphate; ammonium salts; more than about 8 per cent. of carbonate.
What is the dose?
How is commercial sodium bicarbonate prepared?
How much water of crystallization does it contain?
How much water of crystallization does sodium carbonate contain?
Give rationale of process.
What is Solvay's process, or the ammonia-soda process?
Give rationale of process.
What percentage of pure sodium bicarbonate is it required to contain?
How may the following impurities be detected?—viz.: Chloride; sulphate; carbonate.
What is the dose?
Sodium bisulphite—Give formula in symbols and molecular weight.
How is it prepared?
Give rationale of process.
What change takes place on exposure to the air?
For what purpose is it used in the arts?
Describe the chemical reaction which takes place during the process.
How may an impurity of sulphate be detected?
What is the dose?
Sodium borate—Give formula in symbols and molecular weight.
Where does the commercial article come from, and how is it obtained?
What other names has it?
Where is it found native?
How is it made from boric acid?
How much water of crystallization does it contain?
Give odor, taste, and chemical reaction.
What are the tests for identity?
How may the following impurities be detected?—viz.: Carbonate; alkaline earths; metals; sulphate; chloride.

What are its medicinal uses?
For what is it used in pharmacy?
Sodium bromide—Give formula in symbols and molecular weight.
How is this generally made? Give the rationale of the process. Describe the chemical reaction.
How else may it be made?
How may the following impurities be detected?—viz.: Bromate; iodide; sulphate; more than 8 per cent. of chloride.
What is the dose?
Sodium carbonate—Give the formula in symbols and molecular weight.
What is Leblanc's process for its manufacture?
Give the rationale of the process.
What is soda-waste, and for what is it used?
How much sodium carbonate does the soda-ash thus prepared contain?
How may sodium carbonate be obtained from the bicarbonate, and in what process is it so obtained?
What is the process known as the cryolite process?
What is cryolite, and how much sodium is contained in 100 parts of it? What is its formula in symbols?
How is sodium carbonate obtained from cryolite?
Give the rationale of the process.
What percentage of water does sodium carbonate contain? Describe odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Chloride; sulphate; metals; alumina.
What is its use in pharmacy?
Why should the effloresced salt not be used?
What is the dose of it? Why is it rarely used internally?
Dried sodium carbonate—Give the Latin official name.
How is it prepared?
What is the object of driving off the water from the carbonate?
What is the dose?
Sodium chlorate—Give formula in symbols and molecular weight.
What is Wittstein's process for preparing this salt?
Give the rationale of the process.
What special cautionary direction is given with this in the U.S.P., and for what reason? Describe the odor, taste, and chemical reaction.
How may the following impurities be detected?—viz.: Potassium; sulphate; calcium; chloride.
What is the dose?
What advantage has it over potassium chlorate?
Sodium chloride—Give formula in symbols and molecular weight.
Where does it come from?
Describe the odor, taste, and chemical reaction.
How may the following impurities be detected?—viz.: Alkaline earths; sulphate; metals; iodide or bromide.
What is the dose?
Sodium hypophosphite—Give formula in symbols and molecular weight.
How is the salt prepared?
What danger attends the use of too great heat?
What gases are evolved by heat?
What acid is present in this salt, and what is its composition?
Why should it not be prescribed with combinations of mercury or of silver? Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Carbonate; calcium; potassium; sulphate; phosphate.
What are its uses in medicine and in pharmacy?
Sodium hyposulphite—Give formula in symbols and molecular weight.
What is this salt more correctly called? Give the rationale of the process.
How is it made? Describe the odor, taste, and chemical reaction.
How may the following impurities be detected?—viz.: Sulphate; carbonate.
What is the dose?
Sodium iodide—Give formula in symbols and molecular weight.
How may it be prepared? Give rationale of process. Describe the odor, taste, and chemical reaction. What are the tests for identity?

How may the following impurities be detected?—viz.: Iodate; more than about 0.5 per cent. of chloride or bromide; sulphate.
What is the dose?
Sodium nitrate—Give formula in symbols and molecular weight.
What are the common names of this salt, and where is it found? Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Metals; alkaline earths; potassium; sulphate; chloride; iodide.
Sodium nitrite—Give formula in symbols and molecular weight.
How is it prepared?
What are its uses?
Sodium phosphate—Give formula in symbols and molecular weight.
What is the process for making it which was formerly official? Describe rationale of process.
Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Carbonate; metals; sulphate; chloride.
What is the dose?
What is bone-phosphate or bone-ash?
Sodium pyrophosphate—Give formula in symbols and molecular weight.
How is it prepared?
How much water of crystallization does sodium phosphate contain?
Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Carbonate; metals; sulphate; chloride.
For what is it used?
Sodium salicylate—Give formula in symbols and molecular weight.
How is it made?
What precautions must be used in evaporating the solution in order to obtain the salt white and free from the odor of carbolic acid?
Describe the odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Carbonate; foreign organic matter; sulphate; chloride.
What is the dose?
Sodium santoninate—Give formula in symbols and molecular weight.
What is its dose? What are its supposed advantages over santonin?
Sodium sulphate—Give formula in symbols and molecular weight.
How is this salt obtained?
What is the common or popular name? Describe odor, taste, and chemical reaction. Give the tests for identity.
How may the following impurities be detected?—viz.: Carbonate; metals; chloride; ammonia.
How much water of crystallization does it contain?
What is the dose?
Sodium sulphite—Give formula in symbols and molecular weight.
How may this salt be prepared? Describe rationale of process.
What difference is there between the crystallized salt and the granulated salt? Describe odor, taste, and chemical reaction. Give the tests for identity.
How may impurity of sulphate be detected?
What is the dose?
Sodium sulphocarbolate—Give formula in symbols and molecular weight.
How may this salt be made? Describe rationale of process. Describe odor, taste, and chemical reaction. Give the tests for identity.
How may impurity of sulphate be detected?
What is the dose?

CHAPTER XL.

THE LITHIUM SALTS.

THE lithium salts resemble those of potassium and sodium. The metal lithium is comparatively rare, for, although widely distributed in nature, it occurs in such small quantities that the necessary labor to extract it makes it expensive: it is found in *triphyline*, in *spodumene*, and in many mineral waters.

Lithium is a metal resembling potassium and sodium, although much less prone to oxidation: it is soft, *and is the lightest of all known metals*, having the specific gravity of 0.5891. Heated in the air, lithium ignites at a temperature above its fusing point, burning with a bright white light; when thrown on water, it oxidizes, but does not fuse like sodium. Chemically, lithium is a monad, like sodium and potassium.

Tests for Lithium Salts.

1. A colorless flame is colored a vivid red by volatile salts of lithium.
2. Concentrated solutions of lithium salts yield a white precipitate with ammonium carbonate: no precipitate is produced in dilute solution or if ammonia salts are present.
3. Sodium phosphate produces a white precipitate in alkaline or neutral solution, which is soluble in acids and in solutions of ammonia salts.

Official Preparations of Lithium.

Official Name.	Preparation.
Inorganic Radicals.	
Lithii Bromidum	By decomposing ferrous bromide with lithium carbonate.
Lithii Carbonas	By precipitating lithium sulphate with ammonium carbonate.
Organic Radicals.	
Lithii Benzoas	By treating lithium carbonate with benzoic acid.
Lithii Citras	By treating lithium carbonate with citric acid.
Lithii Citras Effervescens	By incorporating lithium carbonate with sodium carbonate, citric acid, and sugar.
Lithii Salicylas	By treating lithium carbonate with salicylic acid.

Unofficial Preparations of Lithium.

Lithii Borocitras. Lithium Borocitrate.	Dissolve 20 Gm. citric acid, 4 Gm. lithium carbonate, and 6 Gm. boric acid in sufficient boiling water, evaporate carefully to dryness, and reduce to a powder.
Lithii Chloridum, $LiCl$. Lithium Chloride.	Dissolve lithium carbonate in hydrochloric acid, and concentrate to crystallize.
Lithii Diborocitras. Lithium Diborocitrate.	Dissolve 20 Gm. citric acid, 7 Gm. lithium carbonate, and 12 Gm. boric acid in sufficient boiling water, evaporate carefully to dryness, and reduce to a powder.
Lithii Iodidum, LiI. Lithium Iodide.	Digest a solution of calcium iodide with lithium carbonate in slight excess, filter, and evaporate to dryness.
Lithii Nitras, $LiNO_3$. Lithium Nitrate.	Dissolve lithium carbonate in nitric acid, filter, and concentrate to crystallize.
Lithii Phosphas, Li_3PO_4. Lithium Phosphate.	Add a solution of lithium carbonate to a solution of sodium phosphate with caustic soda; a crystalline powder will be precipitated.
Lithii Sulphas, $Li_2SO_4.H_2O$. Lithium Sulphate.	Dissolve lithium carbonate in sulphuric acid, filter, and concentrate to crystallize.

LITHII BENZOAS. *U. S.* Lithium Benzoate.

$LiC_7H_5O_2$; 127.72.

Preparation.—This may be made by Shuttleworth's process, which is as follows:

One ounce (av.) of lithium carbonate is put in a capsule with nine fluidounces of water, the mixture is heated, and three and a quarter ounces (av.) of benzoic acid in small portions added, until the carbonate is all decomposed and effervescence ceases: the solution is filtered and evaporated to dryness, or crystallized if desired. The yield is three and a half ounces. The advantage of this process is a saving in time and labor in evaporating.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Benzoic Acid.}}{2HC_7H_5O_2} = \underset{\text{Lithium Benzoate.}}{2LiC_7H_5O_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

Lithii Benzoas. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A light, white powder, or small, shining, crystalline scales, permanent in the air. When heated, the salt fuses; at a higher temperature it chars, emits inflammable vapors having a benzoin-like odor, and finally leaves a residue of lithium carbonate mixed with carbon, which imparts a crimson color to a non-luminous flame, and its aqueous solution has an alkaline reaction upon litmus paper.	Odorless, or having a faintly benzoin-like odor; cooling and sweetish taste; faintly acid reaction.	At 15° C. (59° F.), 4 parts. Boiling, 2.5 parts. The presence of sodium benzoate increases the solubility in water, and lessens that in alcohol.	Cold, 12 parts. Boiling, 10 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If 2 C.c. of ferric chloride T.S. be mixed with a small drop of ammonia water, and added to 2 C.c. of an aqueous solution of the salt, a voluminous brownish-pink precipitate of basic ferric benzoate will result. The aqueous solution (1 in 20) of the salt should remain unaffected by sodium cobaltic nitrite T.S. (limit of potassium), nor should silver nitrate T.S. or barium nitrate T.S. produce in it more than a very slight turbidity (limit of *chloride* and *sulphate*). If a concentrated solution of the salt be mixed with hydrochloric acid, a white precipitate of benzoic acid will be formed, which, after being separated from the liquid, and thoroughly washed and dried, should respond to the tests of purity given under *Acidum Benzoicum*. If the filtrate from this precipitate be evaporated to dryness and ignited, 1 part of the residue should be soluble in 5 parts of absolute alcohol. If to this alcoholic solution an equal volume of ether be added, no precipitate or turbidity should appear (limit of *other alkalies*). If 1 Gm. of dry Lithium Benzoate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 C.c. of water, it should require, for complete neutralization, not less than 7.8 C.c. of normal sulphuric acid (corresponding to not less than 99.6 per cent. of the pure salt), methyl-orange being used as indicator.	Chloride.	If 1 C.c. of diluted nitric acid be added to 0.2 Gm. of Lithium Benzoate, dissolved in 2 C.c. of water, and the precipitated benzoic acid be removed by filtration, the clear filtrate should not be rendered turbid on the addition of silver nitrate T.S.,
	Sulphate.	Or of barium nitrate T.S.
	Arsenic, Lead, Iron, Aluminum, etc.	The aqueous solution (1 in 20) of the salt should remain unaffected by hydrogen sulphide T.S. or ammonium sulphide T.S.,
	Calcium.	Or by ammonium oxalate T.S.,
	Potassium.	Or by sodium cobaltic nitrite T.S.

Uses.—Lithium benzoate is used as a remedy in gout and rheumatism, in doses of fifteen to twenty grains (0.9 to 1.3 Gm.).

LITHII BROMIDUM. *U. S.* Lithium Bromide.

$LiBr$; 86.77.

Preparation.—There are several methods of making this salt: 1. By dissolving lithium carbonate in hydrobromic acid. 2. By mixing solutions of lithium sulphate and potassium bromide. 3. By mixing lithium, carbonate, bromine, and water together, and passing hydrogen sulphide gas through the mixture. 4. By placing 300 grains of iron and 2 fluidounces of water in a flask, and adding gradually 1 oz. av. of bromine, shaking with the application of moderate heat until the mixture has acquired a green color and lost the odor of bromine: the solution of ferrous bromide is then filtered, heated, and 200 grains of lithium carbonate are added. The solution is filtered, and evaporated until the salt granulates.

$$\underset{\text{Ferrous Bromide.}}{FeBr_2} + \underset{\text{Lithium Carbonate.}}{Li_2CO_3} = \underset{\text{Lithium Bromide.}}{2LiBr} + \underset{\text{Ferrous Carbonate.}}{FeCO_3}.$$

Lithii Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
A white, granular salt, very deliquescent. At a low red heat the salt fuses, and at a higher heat it is slowly volatilized. A fragment of the salt imparts a crimson color to a non-luminous flame.	Odorless; sharp, somewhat bitter taste; neutral reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.3 part.	Very soluble.	Soluble in ether.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
If a few drops of chloroform be added to 5 C.c. of the solution (1 in 20), then 1 C.c. of chlorine water, and the mixture shaken, the liberated bromine will dissolve in the chloroform, communicating to it a yellow or yellowish-brown color.	Arsenic, Lead, Copper, etc.	The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S. either before or after acidulation with a drop of hydrochloric acid,
If 0.5 C.c. of sodium cobaltic nitrite T.S. be added to 5 C.c. of the aqueous solution, no precipitate or turbidity should occur within 10 minutes (limit of *potassium*).	Iron, Aluminum.	Nor by ammonium sulphide T.S.
One part of the salt should dissolve, without residue, in 5 parts of absolute alcohol, and the addition of an equal volume of ether should produce no precipitate in this solution (limit of *other alkalies*).	Sulphate.	In the aqueous solution no turbidity should be produced by the addition of barium chloride T.S.
If 0.3 Gm. of dry Lithium Bromide be dissolved in 10 C.c. of water and 2 drops of potassium chromate T.S. be added, it should require 35.3 C.c. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate (corresponding to at least 98 per cent. of the pure salt).	Iodide.	If a few drops of starch T.S. be added to 5 C.c. of the aqueous solution, and then a drop or two of chlorine water, no blue color should appear.

Uses.—Lithium bromide is probably the most efficient of all the bromides as a hypnotic. The dose is fifteen to thirty grains (0.9 to 1.9 Gm.).

LITHII CARBONAS. *U.S.* Lithium Carbonate.

Li_2CO_3; 73.87.

Preparation.—Lithium carbonate may be prepared from lepidolite, one of the minerals in which it is found, in the following manner: 10 parts of finely powdered lepidolite, 10 parts of barium carbonate, 5 parts of barium sulphate, and 3 parts of potassium sulphate are fused at a very high temperature in a wind furnace. The heavy silicate and barium sulphate sink to the bottom, and a layer of potassium and lithium sulphates is found at the top of the fused mass. These can be extracted by simple lixiviation, and then the carbonate prepared by double decomposition with ammonium carbonate.

Lithii Carbonas. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A light, white powder, permanent in the air. At a low red heat the salt fuses; at a higher temperature it loses some of its carbon dioxide, and is partially converted into lithium oxide. It imparts a crimson color to a non-luminous flame.	Odorless; alkaline taste; alkaline reaction.	At 15° C. (59° F.), 80 parts. Boiling, 140 parts. Much more soluble in water saturated with carbon dioxide.	Insoluble.	Soluble in diluted acids, with copious effervescence.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
If 1 Gm. of Lithium Carbonate be dissolved in 40 C.c. of diluted acetic acid, no insoluble residue should remain. If 0.5 Gm. of Lithium Carbonate be dissolved in 2 C.c. of hydrochloric acid, and the clear solution be evaporated to dryness, the dry residue should completely dissolve in 3 C.c. of absolute alcohol, and an addition of 3 C.c. of ether should not render the solution turbid (limit of *other alkalies*). If 0.5 Gm. of the dry salt be mixed with 20 C.c. of water, it should require, for complete neutralization, not less than 13.4 C.c. of normal sulphuric acid (corresponding to at least 98.98 per cent. of the pure salt), methyl-orange being used as indicator.	Limit of Potassium.	A portion of its solution in diluted acetic acid solution should not be affected by sodium cobaltic nitrite T.S.,
	Arsenic, Lead, etc.	Nor by hydrogen sulphide T.S.,
	Iron, Aluminum, etc.	Nor by ammonium sulphide T.S.,
	Calcium.	Nor by ammonium oxalate T.S.,
	Chloride.	Nor by silver nitrate T.S.,
	Sulphate.	Nor by barium chloride T.S.

Uses.—This salt is the source of the lithium salts, and it is prescribed in gout, in doses of five to fifteen grains (0.3 to 0.9 Gm.).

LITHII CITRAS. *U.S.* Lithium Citrate.

$Li_3C_6H_5O_7$; 209.57.

Preparation.—The process formerly official may be usefully employed in making this salt:

Take of Carbonate of Lithium 100 grains; Citric Acid, in crystals, 200 grains; Distilled Water 2 fl. oz. Dissolve the Citric Acid in the

water gently heated, and to the solution gradually add the Carbonate of Lithium until perfectly dissolved, heating the solution so long as effervescence is produced. Evaporate, by means of a steam- or sand-bath, to a viscid consistence, dry the residue in an oven, at a temperature of about 240° F., then rapidly pulverize it, and preserve the powder in a well-stopped bottle.

$$\underset{\text{Lithium Carbonate.}}{3Li_2CO_3} + \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} = \underset{\text{Lithium Citrate.}}{2Li_3C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

Lithium citrate should be kept in well-stopped bottles.

Lithii Citras. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
A white powder, deliquescent on exposure to air. When exposed to a red heat, the salt chars, emits inflammable vapors of a pungent odor, and finally leaves a black residue of lithium carbonate mixed with carbon, which imparts a crimson color to a non-luminous flame.	Odorless; cooling, faintly alkaline taste; neutral reaction.	At 15° C. (59° F.), 2 parts. Boiling, 0.5 part.	Slightly soluble.	Almost insoluble in ether.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If the aqueous solution (1 in 20) of the salt be boiled with an equal volume of calcium chloride T.S., it deposits a white precipitate. If the residue obtained by calcining the salt at a red heat be dissolved in a slight excess of diluted hydrochloric acid, and the filtrate evaporated to dryness, a portion of the residue, treated with 5 parts of absolute alcohol, should completely dissolve; and the addition of an equal volume of ether should not render the solution turbid (limit of *other alkalies*). If 1 Gm. of dry Lithium Citrate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 C.c. of water, it should require for complete neutralization not less than 14.2 C.c. of normal sulphuric acid (corresponding to at least 99.2 per cent. of the pure salt), methyl-orange being used as indicator.	Arsenic, Lead, etc.	Separate portions of the solution, slightly acidulated with acetic acid, should not be affected by hydrogen sulphide T.S.,
	Iron, Aluminum, etc.	Nor by ammonium sulphide T.S.,
	Calcium.	Nor by ammonium oxalate T.S.,
	Limit of Potassium.	Nor by sodium cobaltic nitrite T.S.
	Sulphate.	Not more than a slight turbidity should appear with barium nitrate T.S.,
	Chloride.	Nor with silver nitrate T.S.

Uses.—Lithium citrate is used for the same purpose as lithium carbonate: it is more soluble than the latter. The dose is from fifteen to twenty grains (0.9 to 1.3 Gm.).

LITHII CITRAS EFFERVESCENS. *U.S.* **Effervescent Lithium Citrate.**

	Metric.	Old form.
Lithium Carbonate	70 Gm.	490 grains.
Sodium Bicarbonate	280 Gm.	4 oz. av. 210 gr.
Citric Acid	370 Gm.	5 oz. av. 402 gr.
Sugar, in fine powder, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Triturate the Citric Acid with about 200 Gm. [old form 3 oz. av. 87 gr.] of Sugar, and dry the mixture thoroughly. Then incorporate with it, by trituration, the Lithium Carbonate and Sodium Bicarbonate, and enough Sugar to make the product weigh 1000 Gm. [old form 16 oz. av.]. Keep the powder in well-stoppered bottles.

Uses.—This salt forms a pleasant mode of administering a lithium salt; the dose is one to two drachms (3.9 to 7.8 Gm.).

LITHII SALICYLAS. *U. S.* Lithium Salicylate.

$LiC_7H_5O_3 = 148.68.$

Preparation.—This salt may be prepared by adding 60 grains of lithium carbonate to 1 fluidounce of distilled water and heating the mixture to boiling, then adding 220 grains of salicylic acid and continuing the heat until effervescence ceases, filtering, and evaporating.

$$\underset{\text{Lithium Carbonate.}}{Li_2CO_3} + \underset{\text{Salicylic Acid.}}{2HC_7H_5O_3} = \underset{\text{Lithium Salicylate.}}{2LiC_7H_5O_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

This salt should be kept in well-stoppered bottles.

Lithii Salicylas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A white or grayish-white powder, deliquescent on exposure to air. When heated, the salt is decomposed, emitting the odor of phenol, and finally leaving a black residue of lithium carbonate and carbon, and imparting a crimson color to a non-luminous flame.	Odorless; sweetish taste; faintly acid reaction.	Very soluble.	Very soluble.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
If copper sulphate T.S. be added to an aqueous solution (1 in 20) of the salt, the mixture should have a bright green color.	Iron and Organic Coloring Matters.	The aqueous solution should be colorless,
If a small quantity of ferric chloride T.S. be added to an excess of a concentrated, aqueous solution (1 in 4) of Lithium Salicylate, a deep red color will be produced, which, after the liquid is largely diluted and mixed with more ferric chloride T.S., will change to a deep bluish-violet tint.	Carbonate.	And should not effervesce on the addition of diluted acids.
Upon adding to 1 Gm. of the salt, in a test-tube, about 1 C.c. of concentrated sulphuric acid, then, cautiously, in drops, about 1 C.c. of methylic alcohol, and heating the mixture to boiling, the odor of oil of gaultheria will be evolved.	Readily Carbonizable Organic Impurities.	If 1 part of the salt be agitated with 15 parts of sulphuric acid, no color should be imparted to the acid within 15 minutes.
Hydrochloric or sulphuric acid produces in the aqueous solution a voluminous precipitate of salicylic acid, which, when separated and washed, should conform to the reaction and tests given under *Acidum Salicylicum*.	Sulphate.	If a portion of the residue, left after ignition, be dissolved in diluted acetic acid, separate portions of the filtrate should not be rendered turbid on addition of a few drops of barium chloride T.S.,
If another portion of the residue, left after ignition, be dissolved in diluted hydrochloric acid, and the filtrate evaporated to dryness, a portion of the residue, when treated with 5 parts of absolute alcohol, should completely dissolve, and the addition of an equal volume of ether should not render the solution turbid (limit of *other alkalies*).	Limit of Chloride.	Nor more than slightly turbid by silver nitrate T.S.
	Arsenic, Lead, etc.	Other portions of the same filtrate should not be affected by hydrogen sulphide T.S.,
	Aluminum, etc.	Nor by ammonium sulphide T.S.,

TESTS.—*Continued.*

TESTS FOR IDENTITY AND QUANTITATIVE TESTS.	IMPURITIES.	TESTS FOR IMPURITIES.
If 2 Gm. of dry Lithium Salicylate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 C.c. of water, it should require, for complete neutralization, not less than 13.8 C.c. of normal sulphuric acid (corresponding to at least 99.13 per cent. of the pure salt), methyl-orange being used as indicator.	Calcium. Limit of Potassium.	Nor by ammonium oxalate T.S., Nor by sodium cobaltic nitrite T.S.

Uses.—This salicylate is used, like sodium salicylate, for rheumatism and gout: it is given in doses of twenty to forty grains (1.3 to 2.6 Gm.).

QUESTIONS ON CHAPTER XL.

THE LITHIUM SALTS.

What salts do the lithium salts resemble? How is lithium obtained?

What is its specific gravity? What is its chemical quantivalence?

What are the tests for lithium salts?

Benzoate of lithium—Give formula in symbols and molecular weight.

How may it be made? Describe rationale of process. Give tests for identity. Describe odor, taste, chemical reaction, and solubility.

How may the following impurities be detected?—viz.: Salts of alkalies; salts of alkaline earths; metals. What is the dose?

Bromide of lithium—Give formula in symbols and molecular weight.

In what various ways may this salt be made? Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Salts of alkalies; salts of alkaline earths; metals. What is the dose?

Carbonate of lithium—Give formula in symbols and molecular weight. How may it be prepared? Describe odor, taste, and chemical reaction. What is the dose?

Citrate of lithium—Give formula in symbols and molecular weight.

What is the process for making it which was formerly officinal?

Give rationale of process. Describe odor, taste, chemical reaction, and solubility.

What is the official Latin name of effervescent lithium citrate?

Give its formula and mode of preparation.

Salicylate of lithium—Give formula in symbols and molecular weight.

How may it be prepared? Describe rationale of process. Describe odor, taste, chemical reaction, and solubility. Give the tests for identity.

How may the following impurities be detected?—viz.: Carbonate; foreign organic matters; salts of alkalies. What is the dose?

CHAPTER XLI.

AMMONIUM.

THE ammonium salts resemble those of the alkali metals so closely in their physical and chemical properties that they are appropriately considered in this place.

The metal ammonium has not yet been isolated in the free state, so that its appearance cannot be described. An *ammonium amalgam* is known, however, made by dissolving potassium in mercury and adding a strong solution of ammonium chloride to it. It is a spongy, metallic substance, which easily decomposes into ammonia, mercury, and hydrogen.

Tests for Ammonium Salts.

1. At high temperatures ammonium compounds are volatilized.
2. When heated with sodium, potassium, or calcium hydrate, the odor of ammonia is evolved: the latter restores the color of reddened litmus paper, and darkens the blue color of paper moistened with solution of copper sulphate. Ammonia forms a white cloud with vapor of hydrochloric acid.
3. Solution of platinic chloride, with a few drops of hydrochloric acid, if added to a solution of an ammonium salt, produces a yellow precipitate.
4. Ammonium salts are mostly colorless, and generally very soluble in water.

Official Preparations of Ammonium.

Official Name.	Composition and Preparation.
Aqua Ammoniæ	10 per cent. by weight aqueous solution of NH_3.
Aqua Ammoniæ Fortior	20 per cent. by weight aqueous solution of NH_3.
Spiritus Ammoniæ	10 per cent. by weight alcoholic solution of NH_3.
Spiritus Ammoniæ Aromaticus	An aromatic hydro-alcoholic solution of ammonium carbonate.
Linimentum Ammoniæ	35 C.c. ammonia water; 5 C.c. alcohol; 60 C.c. cotton seed oil.
Liquor Ammonii Acetatis	Made by mixing solution of acetic acid and ammonium carbonate.
Ammonii Benzoas	By dissolving benzoic acid in ammonia water.
Ammonii Bromidum	By adding ammonia water gradually to bromine under water.
Ammonii Carbonas	By subliming a mixture of ammonium chloride and calcium carbonate.
Ammonii Chloridum	By subliming a mixture of ammonium sulphate and sodium chloride.
Ammonii Iodidum	By mixing solutions of potassium iodide and ammonium sulphate.
Ammonii Nitras	By treating ammonium carbonate with nitric acid.
Ammonii Valerianas	By passing ammonia gas into monohydrated valerianic acid.
Trochisci Ammonii Chloridi	1.5 gr. ammonium chloride in each lozenge.

Unofficial Preparations of Ammonium.

Ammonii Arsenas, $(NH_4)_2,H,AsO_4$. Ammonium Arsenate.	Saturate a concentrated solution of arsenous acid with ammonia water and allow it to evaporate spontaneously.
Ammonii Bicarbonas, NH_4HCO_3. Ammonium Bicarbonate.	Treat 1 Gm. powdered ammonium carbonate with 2 Gm. water, and decant the liquid, the residue being the bicarbonate.
Ammonii Bichromas, $(NH_4)_2Cr_2O_7$. Ammonium Bichromate.	Add chromic acid to ammonia water, and concentrate to crystallize.
Ammonii Boras, $2(NH_4HBr_2O_4).3H_2O$. Ammonium Borate.	Dissolve 1 Gm. boric acid in 3 Gm. warm ammonia water, sp. gr. 960, and allow to cool slowly.
Ammonii Carbonas Pyro-oleosus. Pyro-oleous Ammonium Carbonate.	Incorporate thoroughly 32 Gm. ammonium carbonate with 1 Gm. ethereal animal oil.
Ammonii Citras, $(NH_4)_3C_6H_5O_7 + 3H_2O$. Ammonium Citrate.	Dissolve 1 Gm. citric acid in water, add sufficient ammonia water to neutralize, filter, and concentrate to crystallize.
Ammonii et Ferri Chloridum. Ammonium and Iron Chloride.	Mix 32 Gm. ammonium chloride with 9 Gm. solution of ferric chloride, and evaporate to dryness with constant stirring.
Ammonii et Potassii Tartras. Ammonium and Potassium Tartrate.	Add ammonium carbonate to a hot solution of acid potassium tartrate until neutralized, evaporate and crystallize.
Ammonii Formas, NH_4CHO_2. Ammonium Formate.	Neutralize formic acid with ammonia water, and evaporate to crystallize.
Ammonii Fluoridum, NH_4F. Ammonium Fluoride.	Saturate hydrofluoric acid with ammonia water.
Ammonii Nitris, NH_4NO_2. Ammonium Nitrite.	Add a solution of ammonium chloride to one of silver nitrate, and evaporate the clear solution over sulphuric acid to dryness.
Ammonii Phosphas, $(NH_4)_2HPO_4$. Ammonium Phosphate.	By mixing solutions of phosphoric acid and ammonia.
Ammonii Salicylas, $(NH_4)C_7H_5O_3$. Ammonium Salicylate.	Neutralize salicylic acid with ammonia water, and evaporate to crystallize.
Ammonii Sulphas $(NH_4)_2SO_4$. Ammonium Sulphate.	By saturating gas liquor with sulphuric acid and crystallizing.
Ammonii Sulphis, NH_4HSO_3. Ammonium Sulphite.	Pass sulphurous acid into an alcoholic solution of ammonia, and collect the precipitate.
Ammonii Sulphocyanidum, NH_4CNS. Ammonium Sulphocyanide.	Dissolve carbon bisulphide in alcohol, and heat in the presence of ammonia water. Lastly, concentrate to crystallize.

AQUA AMMONIÆ. *U. S.* Ammonia Water.

An aqueous solution of ammonia [NH_3; 17.01], containing 10 per cent., by weight, of the gas. It should be kept in glass-stoppered bottles, in a cool place.

Preparation.—This useful liquid is rarely prepared by the pharmacist, for the reason that it can be made more economically by the manufacturer. The official process of 1870 (see U. S. Dispensatory, 17th edition, p. 119) directed that it should be made by mixing ammonium chloride, in small pieces, with milk of lime, and placing the mixture in a retort, connected with a cooled receiver by means of a glass tube, the end of which was dipped beneath the surface of distilled water contained in the receiver. The rationale of this process is that the lime is converted into calcium chloride, whilst the ammoniacal gas, liberated by the heat, is dissolved in the distilled water.

$$\underset{\text{Ammonium Chloride.}}{2NH_4Cl} + \underset{\text{Calcium Hydrate.}}{Ca2HO} = \underset{\text{Ammonia.}}{2NH_3} + \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Water.}}{2H_2O}.$$

The manufacturer rarely uses ammonium chloride: the sulphate is cheaper, and it is frequently employed instead. But upon the large scale the ammoniacal liquor obtained from gas-works is used directly

as the source, being mixed with milk of lime and heated; the gaseous ammonia is then passed through a series of tubes filled with charcoal, which retain the empyreumatic products. If the tubes are long enough, and sufficient charcoal is employed, a pure product is assured; but much of the commercial ammonia water is empyreumatic through defective purification.

Aqua Ammoniæ. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A colorless, transparent liquid. It is completely volatilized by the heat of a water-bath. Sp. gr. 0.960 at 15° C. (59° F.).	Very pungent odor; acrid, alkaline taste; strongly alkaline reaction.	Miscible in all proportions with water and alcohol.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On bringing a glass rod dipped into hydrochloric acid near the liquid, dense white fumes are evolved. To neutralize 3.4 Gm. (3.54 C.c.) of Ammonia Water should require 20 C.c. of normal sulphuric acid (each C.c. corresponding to 0.5 per cent. of ammonia), rosolic acid being used as indicator.	Empyreuma.	On supersaturating Ammonia Water with diluted sulphuric acid, no empyreumatic odor or red color should be developed.
	Readily Oxidizable Matters.	If to this liquid 1 C.c. of centinormal potassium permanganate V.S. be added, the pink color should not be completely destroyed within ten minutes.
	Traces of Carbonic Acid.	Ammonia Water should remain clear or be at most only faintly clouded when mixed with 4 times its volume of calcium hydrate T.S.
	Sulphate.	When Ammonia Water is supersaturated with nitric acid, the liquid should remain clear on the addition of barium chloride T.S.
	Chloride.	When Ammonia Water is supersaturated with nitric acid, the liquid should remain clear on the addition of silver nitrate T.S.
	Metallic Impurities.	Either before or after neutralizing Ammonia Water with hydrochloric acid, it should not be affected by hydrogen sulphide T.S.
	Calcium.	Test-solution of ammonium oxalate should not affect ammonia water if diluted with twice its volume of water.
	Coal-tar Bases and fixed Impurities.	If a third portion of the acidulated liquid be evaporated on a water-bath to dryness, it should afford a colorless residue, which, on ignition, should be completely volatilized.

Uses.—Pharmaceutically, ammonia water is frequently used to precipitate iron salts by combining with the acid radicals, ferric hydrate being thrown down. Its advantage over the fixed alkalies consists in its volatility, any excess being readily detected by the odor. It is largely used for cleaning fabrics, although the strength technically known as "Aqua Ammoniæ F. F. F.," or "20° Ammonia," is employed most frequently in the arts; the latter may be diluted with water, according to the formula given on page 98, if it is desirable to make official ammonia water from it. In round numbers, three parts of 20° ammonia water require two parts of water to reduce it to the strength of official ammonia water. Ammonia water is rarely used internally, the aromatic spirit being preferred. The dose is ten to twenty minims (0.6 to 1.2 C.c.), largely diluted. Externally, it is caustic and stimulating. Its old name is *Spirits of Hartshorn.*

AQUA AMMONIÆ FORTIOR. *U. S.* Stronger Ammonia Water.

An aqueous solution of Ammonia [NH_3; 17.01], containing 28 per cent., by weight, of the gas. It should be kept in strong, glass-stoppered bottles, not completely filled, in a cool place.

Preparation.—Stronger ammonia water is prepared in the same way that ammonia water is, the only difference between the two solutions being that of relative strength.

Description and Tests.—It is officially described as a colorless, transparent liquid, of an excessively pungent odor, a very acrid and alkaline taste, and a strongly alkaline reaction. Specific gravity, 0.901 at 15° C. (59° F.). Its reactions for identity and purity are the same as those of Aqua Ammoniæ. To neutralize 1.7 Gm. (1.88 C.c.) of Stronger Ammonia Water should require 28 C.c. of normal sulphuric acid (each C.c. corresponding to 1 per cent. of ammonia), rosolic acid being used as indicator.

Uses.—This liquid is used externally as a caustic and vesicant. It is too strong for internal administration.

SPIRITUS AMMONIÆ. *U. S.* Spirit of Ammonia.

An alcoholic solution of ammonia [NH_3; 17.01], containing 10 per cent., by weight, of the gas.

	Metric.	Old form.
Stronger Ammonia Water	250 C.c.	8 fl. oz.
Alcohol, recently distilled, and, after distillation, kept in glass vessels, a sufficient quantity,		
To make		about 16 fl. oz.

Pour the Stronger Ammonia Water into a flask provided with a safety funnel, and connected by means of a glass condenser with a well-cooled receiver containing 500 C.c. [old form 16 fl. oz.] of Alcohol, the delivery tube of the condenser reaching to near the bottom of the receiver. Heat the flask carefully, and very gradually, to a temperature not exceeding 60° C. (140° F.), and maintain it at that temperature for about ten minutes. Then disconnect the receiver, and, having ascertained the ammoniacal strength of the contents by means of normal sulphuric acid (rosolic acid test-solution being used as indicator), add enough Alcohol to make the product contain *ten per cent.*, by weight, of Ammonia. Keep the Spirit in glass-stoppered bottles, in a cool place.

This is an alcoholic solution of ammonia gas, of exactly the same strength as ammonia water. The object of selecting a stronger aqueous solution of the same gas, to furnish the active ingredient, was to obtain an accurate and uniform quantity of the latter conveniently and without contamination. Practically, considerable difficulty will be experienced in maintaining the temperature of 60° C. (140° F.) for ten minutes. The amount of ammonia present is determined by a volumetric assay, in which 3.4 Gm. of the spirit of ammonia, diluted with distilled water, should require, for complete neutralization, 20 C.c. of normal sulphuric acid (each C.c. corresponding to 0.5 per cent. of Ammonia). When diluted with water it should respond to the tests and reactions for Ammonia Water. Sp. gr. 0.810.

Uses.—Spirit of ammonia is antacid and stimulant. It is not used internally to any extent, the aromatic spirit of ammonia being preferred. The dose is from ten to twenty minims (0.6 to 1.2 C.c.), largely diluted with water.

SPIRITUS AMMONIÆ AROMATICUS. *U.S.* Aromatic Spirit of Ammonia.

	Metric.	Old form.
Ammonium Carbonate, in translucent pieces	34 Gm.	500 grains.
Ammonia Water	90 C.c.	2 fl. oz. 7 fl. dr.
Oil of Lemon	10 C.c.	2½ fl. dr.
Oil of Lavender Flowers	1 C.c.	15 minims.
Oil of Nutmeg	1 C.c.	15 minims.
Alcohol	700 C.c.	22 fl. oz. 3 fl. dr.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

To the Ammonia Water, contained in a flask, add 140 C.c. [old form 4½ fl. oz.] of Distilled Water, and afterwards the Ammonium Carbonate reduced to a moderately fine powder. Close the flask and agitate the contents until the Carbonate is dissolved. Introduce the Alcohol into a graduated bottle of suitable capacity, add the oils, then gradually add the solution of Ammonium Carbonate, and afterwards enough Distilled Water to make the product measure 1000 C.c. [old form 2 pints]. Set the liquid aside during twenty-four hours in a cool place, occasionally agitating, then filter it, through paper, in a well-covered funnel.

This preparation acquires a dark color by keeping, although nearly colorless when freshly prepared. The discoloration is due to the action of the alkali upon the alcohol and volatile oils. It should have the specific gravity of 0.905. As ordinarily prepared, from unselected ammonium carbonate, precipitation is very apt to take place: this is due to the use of exposed and effloresced ammonium carbonate, which contains more than the proper quantity of bicarbonate (see Ammonii Carbonas). The addition of ammonia water in the formula is to convert the bicarbonate into the carbonate, the latter being soluble in the mixture of water and alcohol, whilst the bicarbonate is insoluble in alcohol. Sufficient time should be given to effect the solution. The ammonium carbonate should be carefully selected, and only the translucent pieces used.

Uses.—This is a very valuable and largely used antacid and stimulant: the dose is from twenty to sixty minims (1.23 to 3.7 C.c.), largely diluted with water.

LIQUOR AMMONII ACETATIS. *U.S.* Solution of Ammonium Acetate.

[SPIRIT OF MINDERERUS.]

An aqueous solution of Ammonium Acetate [$NH_4C_2H_3O_2 = 76.87$], containing about 7 per cent. of the salt, together with small amounts of acetic and carbonic acids.

	Metric.	Old form.
Ammonium Carbonate	5 Gm.	365 grains.
Diluted Acetic Acid	100 C.c.	16 fl. oz.

Add the Ammonium Carbonate (which should be in translucent pieces, free from white, pulverulent bicarbonate) gradually to the cold Diluted Acetic Acid, and stir until it is dissolved.

This preparation should be freshly made when wanted.

Solution of Ammonium Acetate may also be prepared in the following manner:

	Metric.	Old form.
Ammonium Carbonate	10 Gm.	2 oz. av.
Acetic Acid	28 Gm.	4¾ fl. oz.
Distilled Water	142 Gm.	about 27 fl. oz.

Dissolve the Ammonium Carbonate in 80 Gm. [old form 1 pint] of Distilled Water, and filter the solution. To the Acetic Acid add 62 Gm. [old form sufficient to make 1 pint] of Distilled Water. Keep the solutions in separate, well-stopped bottles, and, when Solution of Ammonium Acetate is to be dispensed, weigh (or, if the alternative formula is used, measure) equal quantities of each solution and mix them.

The reaction involved in this process depends upon the decomposition of the ammonium carbonate with acetic acid: the free carbonic acid is a desirable addition to the solution, which should be dispensed with a moderate amount in solution.

$$\underbrace{(NH_4HCO_3)NH_4NH_2CO_2}_{\text{Acid Ammonium Carbonate and Carbamate.}} + \underbrace{3HC_2H_3O_2}_{\text{Acetic Acid.}} = \underbrace{3NH_4C_2H_3O_2}_{\text{Ammonium Acetate.}} + \underbrace{2CO_2}_{\text{Carbon Dioxide.}} + \underbrace{H_2O}_{\text{Water.}}$$

It will be found in practice that the last formula is much more satisfactory than the first. The solutions keep well, and it is very convenient to mix them at the time of dispensing, and thus always be enabled to send out a fresh preparation, which retains sufficient carbonic acid gas to be grateful to the patient.

Liquor Ammonii Acetatis. *U.S.*	Taste and Reaction.	Solubility.
A clear, colorless liquid, free from empyreuma. It is wholly volatilized by heat.	Mildly saline taste; neutral or slightly acid reaction.	Freely miscible with water and alcohol.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated with potassa, it evolves vapor of ammonia, and, when heated with sulphuric acid, it gives out vapor of acetic acid. It contains about 7 per cent. of ammonium acetate.	Metals.	It should not be darkened by hydrogen sulphide or ammonium sulphide.

Uses.—This solution is used as a diaphoretic or diuretic, in the dose of half a fluidounce (15 C.c.).

AMMONII BENZOAS. *U.S.* Ammonium Benzoate.

$NH_4C_7H_5O_2$; 138.72.

Preparation.—This salt may be advantageously prepared by the former official process, which is as follows:

Take of Benzoic Acid 2 oz. troy; Water of Ammonia 3½ fl. oz., or

a sufficient quantity; Distilled Water 4 fl. oz. Dissolve the Acid in 3½ fl. oz. of the Water of Ammonia, previously mixed with the Distilled Water; evaporate with a gentle heat, occasionally adding Water of Ammonia, if necessary, to maintain a slight excess of the alkali; then set aside to crystallize, and dry the crystals without heat.

Ammonium Benzoate should be kept in well-stoppered bottles.

The process is one of direct combination, the reaction being as follows:

$$\underset{\text{Benzoic Acid.}}{HC_7H_5O_2} + \underset{\text{Ammonia Water.}}{NH_4HO} = \underset{\text{Ammonium Benzoate.}}{NH_4C_7H_5O_2} + \underset{\text{Water.}}{H_2O}.$$

The object of retaining an excess of alkali in the process is to prevent the formation of the acid benzoate, which is less soluble than the official salt.

Ammonii Benzoas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Thin, white, four-sided, laminar crystals, gradually losing ammonia on exposure to the air. When strongly heated, the salt melts, emits vapors having the odor of ammonia and of benzoic acid, and is finally wholly dissipated. A saturated, aqueous solution of the salt affords, with ferric chloride T.S., a flesh-colored precipitate, and, when it is gently heated with potassium or sodium hydrate T.S., the odor of ammonia is evolved.	Slight odor of benzoic acid; saline, bitter, afterwards slightly acrid taste; neutral or slightly acid reaction.	At 15° C. (59° F.), 5 parts. Boiling, 1.2 parts.	At 15° C. (59° F.), 28 parts. Boiling, 7.6 parts.

Impurities.	Tests for Impurities.
Sulphates.	If diluted nitric acid be added to a 10-per-cent. aqueous solution of the salt, a precipitate of benzoic acid is produced, and the filtrate from this precipitate should *not* be affected by barium chloride T.S.
Chlorides.	Or silver nitrate T.S.

Uses.—Ammonium benzoate is used as a stimulant diuretic, in doses of five to twenty grains (0.3 to 1.3 Gm.).

AMMONII BROMIDUM. *U. S.* Ammonium Bromide.

$NH_4Br = 97.77.$

Preparation.—Several methods have been employed in making this salt: 1. By double decomposition between solutions of ammonium sulphate and potassium bromide, alcohol being added to separate the ammonium bromide. 2. By adding ammonia water to a solution of ferrous bromide. 3. By Pile's process, in which one pound of bromine is poured carefully into four times its weight of distilled water in a stone jar, adding *very gradually*, a fluidounce at a time, about one quart of ammonia water, covering the top of the jar with a glass plate when vapors arise, and, when all the ammonia has been added, and the solution is free from the smell of bromine, evaporating and granulating: the yield is about twenty ounces.

$$\underset{\text{Bromine.}}{6Br} + \underset{\text{Ammonia.}}{8NH_3} = \underset{\text{Ammonium Bromide.}}{6NH_4Br} + \underset{\text{Nitrogen.}}{N_2}.$$

Ammonii Bromidum. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, transparent, prismatic crystals, or a white, crystalline powder, permanent in the air. Upon ignition the salt volatilizes completely without melting.	Odorless; pungent, saline taste; slightly acid reaction.	At 15° C. (59° F.), 1.5 parts. Boiling, 0.7 part.	Cold, 30 parts. Boiling, 15 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution, when heated with potassa or sodium hydrate T.S., evolves ammonia. If a little chloroform be poured into the solution, then chlorine water added drop by drop, and the whole agitated, the chloroform will acquire a yellow or yellowish-brown color without a violet tint.	Bromate.	If diluted sulphuric acid be dropped on the salt, the latter should not at once assume a yellow color.
	More than 1 per cent. of Ammonium Chloride.	If 3 Gm. of the well-dried salt be dissolved in distilled water to 100 C.c., 10 C.c. of this solution, after the addition of a few drops of potassium chromate T.S., should require not more than 30.9 C.c. of decinormal silver nitrate V.S. to produce a permanent red coloration.
	Metals.	A 10-per-cent. aqueous solution should not be affected by hydrogen sulphide T.S.,
	Sulphate.	Nor by barium chloride.
	Limit of Iron.	20 C.c. of a 5-per-cent. aqueous solution of the salt should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S.

Uses.—Ammonium bromide is sometimes preferred to potassium bromide as a hypnotic and sedative; it is asserted that it does not produce bromism. The dose is from ten to sixty grains (0.65 to 3.9 Gm.).

AMMONII CARBONAS. *U.S.* Ammonium Carbonate.

$$NH_4HCO_3.NH_4NH_2CO_2 = 156.77.$$

Ammonium carbonate should be kept in well-stoppered bottles, in a cool place.

Preparation.—The large consumption of this salt of ammonium has led to several methods of preparation. The one which is most used at present is the dry sublimation of ammonium chloride or ammonium sulphate with chalk or calcium carbonate: by double decomposition calcium chloride or calcium sulphate and ammonium carbonate are produced.

$$\underset{\text{Ammonium Chloride.}}{4NH_4Cl} + \underset{\text{Calcium Carbonate.}}{2CaCO_3} = \underset{\text{Ammonium Carbonate.}}{N_3H_{11}C_2O_5} + \underset{\text{Calcium Chloride.}}{2CaCl_2} + \underset{\text{Ammonia.}}{NH_3} + \underset{\text{Water.}}{H_2O}.$$

The advantage claimed for the use of ammonium sulphate is simply that of greater economy.

Official ammonium carbonate is, chemically, a mixed salt. It consists of one molecule of acid ammonium carbonate or bicarbonate and one of ammonium *carbamate:* the latter may be regarded as ammonium carbonate minus a molecule of water. If ammonium carbamate is dissolved in water, it is soon changed to neutral ammonium carbonate.

$$\underset{\text{Ammonium Carbamate.}}{NH_4NH_2CO_2} + \underset{\text{Water.}}{H_2O} = \underset{\text{Neutral Ammonium Carbonate.}}{(NH_4)_2CO_3}.$$

Hence an aqueous solution of commercial ammonium carbonate contains both the neutral and acid carbonates. If the official ammonium carbonate is exposed to the air, it is soon changed into the acid carbonate or bicarbonate, through loss of ammonia, and it is thus depreciated in quality. The bicarbonate may be converted into the carbonate by treating it with ammonia water. This fact is officially recognized in the preparation of Aromatic Spirit of Ammonia, and *smelling salts* is frequently made by coarsely grinding ammonium carbonate, placing it in a bottle, and adding strong ammonia water until it is saturated.

The principal impurity in the commercial salt is empyreuma, due to the presence of substances which communicate a disagreeable, charred odor and taste. The official test provides for the detection of empyreumatic products by first neutralizing the alkali with nitric acid and evaporating on a water-bath. The residue should be odorless and colorless.

Ammonii Carbonas. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
White, hard, translucent, striated masses, which lose both ammonia and carbonic acid gas on exposure to air, becoming opaque and finally converted into friable, porous lumps, or a white powder (Acid Ammonium Carbonate).	Strongly ammoniacal odor, free from empyreuma; sharp, saline taste, strongly alkaline reaction, and effervesces with acids.	At 15° C. (59° F.), 5 parts. Decomposed by hot water with the elimination of carbonic acid and ammonia. By prolonged boiling with water the salt is completely dissipated.	Dissolves the carbamate and leaves the Acid Ammonium Carbonate (Bicarbonate).

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated, the salt is completely volatilized, without charring. If the aqueous solution is heated to near 47° C. (116.6° F.), it begins to lose carbonic acid gas, and at 88° C. (190.4° F.) it begins to give off vapor of ammonia. Dilute acids wholly dissolve the salt with effervescence. If 7.84 Gm. of unaltered Ammonium Carbonate be dissolved in water to the volume of 90 C.c., 30 C.c. of this solution (containing 2.613 Gm. of the salt) should require, for exact neutralization, 50 C.c. of normal sulphuric acid (each C.c. corresponding to 2 per cent. of the pure salt), rosolic acid being used as indicator.	Sulphate.	On acidulating the aqueous solution of Ammonium Carbonate with acetic acid, no turbidity should be produced by barium chloride T.S.,
	Calcium.	Nor by ammonium oxalate T.S.
	Hyposulphite.	A 5-per-cent. aqueous solution, on the addition of a slight excess of silver nitrate T.S., and subsequent supersaturation with nitric acid, should neither assume a brown color,
	Limit of Chloride.	Nor become more than slightly opalescent within two minutes.
	Metals.	On acidulating the aqueous solution of Ammonium Carbonate with acetic acid, no turbidity should be produced by hydrogen sulphide T.S.
	Empyreumatic or Non-volatile Matters.	If 1 Gm. of the salt be slightly supersaturated with nitric acid, and the solution evaporated to dryness on a water-bath, it should afford a colorless and odorless residue, which, upon gentle ignition, should be completely volatilized.

Uses.—Ammonium carbonate is a stimulant in doses of three to five grains (0.19 to 0.32 Gm.). It is generally administered in mucilaginous syrups. Pharmaceutically, it is employed in making the well-known solution of ammonium acetate, and in the aromatic spirit of ammonia, before mentioned.

AMMONII CHLORIDUM. *U. S.* Ammonium Chloride.

$NH_4Cl = 53.38.$

Preparation.—Sal ammoniac, as it is termed commercially, is chiefly made from *gas liquor*, the ammoniacal liquid obtained from gas-works during the destructive distillation of the coal. The ammonia is generally neutralized with hydrochloric acid, the solution evaporated, and the dry mass sublimed in iron pots. The tough, fibrous sublimate is fitted for pharmaceutical and medicinal purposes by purification. It nearly always contains traces of iron, due to the reaction of a portion of the salt upon the cast-iron dome. This may be separated by treatment with ammonia water, as shown in the following process of purification, formerly official:

Take of Chloride of Ammonium, in small pieces, 20 oz. troy; Water of Ammonia, 5 fl. dr.; Water, 2 pints. Dissolve the Chloride of Ammonium in the Water, in a porcelain dish, with the aid of heat; add the Water of Ammonia, and continue the heat for a short time; filter the solution while hot, and evaporate to dryness, with constant stirring, at a moderate heat, until it granulates: the ferrous chloride is converted into insoluble ferric hydrate, through the combination of the hydrochloric acid with ammonia water.

Ammonii Chloridum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A white, crystalline powder, permanent in the air. On ignition, the salt volatilizes, without charring.	Odorless; cooling, saline taste; aqueous solution has a neutral reaction.	At 15° C. (59° F.), 3 parts. Boiling, 1 part.	Very sparingly.

Tests for Identity.	Impurities.	Tests for Impurities.
Test-solution of silver nitrate, added to the aqueous solution, produces a white, curdy precipitate soluble in ammonia water.	Barium.	A 5-per-cent aqueous solution of the salt should remain unaffected by diluted sulphuric acid.
	Metals.	A 5-per-cent. aqueous solution of the salt should remain unaffected by hydrogen sulphide T.S.,
	Sulphate.	Or barium chloride,
	Calcium.	Or ammonium oxalate.
Another portion of the aqueous solution, when gently heated with potassium or sodium hydrate T.S., evolves the odor of ammonia.	Iron.	20 C.c. of a 5-per-cent. aqueous solution should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S.
	Sulphocyanate.	When acidulated with hydrochloric acid, the solution should not assume a red color on the addition of a few drops of ferric chloride T.S.
	Empyreumatic or Non-volatile Matters.	If to 1 Gm. of the salt a little nitric acid be added, and the mixture evaporated to dryness in a porcelain capsule on a water-bath, a white residue should be obtained, which, when more strongly heated, should be completely volatilized.

Uses.—Ammonium chloride is a stimulant, and largely used as an addition to expectorant remedies, in doses of five to ten grains (0.3 to 0.65 Gm.). It is sometimes used as an inhalation in catarrh, by drawing the vapors of hydrochloric acid and ammonia into a bottle, where they combine to form ammonium chloride in very fine powder. It should never be combined with potassium chlorate, particularly in compressed tablets; for, although the combination is often desirable from a therapeutic stand-point, in time the tablets explode and serious results have been experienced. The exact results of the decomposition have not yet been determined.

AMMONII IODIDUM. *U.S.* Ammonium Iodide.

$NH_4I = 144.54.$

Ammonium Iodide should be kept in small, well-stoppered vials, protected from light. When deeply colored, the salt should not be dispensed; but it may be deprived of free iodine by adding to its concentrated, aqueous solution sufficient ammonium sulphide T.S. to render it colorless, then filtering, and evaporating on a water-bath to dryness.

Preparation.—This salt may be made by a modification of a former official process, as follows:

Take of Iodide of Potassium, in coarse powder, 4 oz. troy; Sulphate of Ammonium, in coarse powder, 867 grains; Boiling Distilled Water 2 fl. oz.; Alcohol, Water, each, a sufficient quantity. Mix the salts, add them to the Boiling Water, stir well, and allow the mixture to cool; then add a fluidounce of Alcohol, mix well, and reduce the temperature, by a bath of iced water, to about 40° F.; throw the mixture into a cool glass funnel, stopped with moistened cotton, and, when the clear solution has passed, pour upon the salt a fluidounce of a mixture containing two parts of Water and one part of Alcohol. Lastly, evaporate the solution rapidly to dryness, stirring constantly; and preserve the residue in a well-stopped bottle.

In this process double decomposition takes place, ammonium iodide and potassium sulphate being produced.

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Ammonium Sulphate.}}{(NH_4)_2SO_4} = \underset{\text{Ammonium Iodide.}}{2NH_4I} + \underset{\text{Potassium Sulphate.}}{K_2SO_4}.$$

The object of cooling the mixture and adding alcohol is to cause as much of the potassium sulphate to separate as possible, potassium sulphate being almost insoluble in alcohol.

Ammonii Iodidum. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Minute, colorless, cubical crystals, or a white, granular powder. When heated on platinum foil, it evolves vapor of iodine, and volatilizes completely without melting. The salt is very hygroscopic, and soon becomes yellow or yellowish-brown on exposure to the air and light, owing to the loss of ammonia and the elimination of iodine.	Odorless when white. but emitting a slight odor of iodine when colored; sharp, saline taste; neutral reaction.	At 15° C. (59° F.), 1 part. Boiling, 0.5 part.	Cold, 9 parts. Boiling, 3.7 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. If a little chloroform be poured into the solution, then chlorine water added drop by drop, and the whole agitated, the chloroform will acquire a violet color.	Sulphate.	On adding to 1 Gm. of the salt, dissolved in 20 C.c. of water (with a few drops of diluted hydrochloric acid), 5 or 6 drops of barium chloride T.S., no immediate cloudiness or precipitate should make its appearance.
	More than about 0.5 per cent. of Chloride and Bromide.	If 0.25 Gm. of the salt be dissolved in 10 C.c. of ammonia water, then shaken with 19 C.c. of decinormal silver nitrate V.S., and the filtrate supersaturated with 5 C.c. of nitric acid, no cloudiness should make its appearance within ten minutes.
	Iron.	A 1-per-cent. aqueous solution should not be colored blue by potassium ferrocyanide T.S.
	Iodine.	A 1-per-cent. aqueous solution, after being mixed with gelatinized starch, should not assume a deep blue color.

Uses.—Ammonium iodide is used as a resolvent and alterative, for the same purposes as potassium iodide. The dose is from three to five grains (0.19 to 0.33 Gm.).

AMMONII NITRAS. *U.S.* Ammonium Nitrate.

$NH_4NO_3 = 79.9.$

Preparation.—Ammonium nitrate may be prepared by treating commercial ammonium carbonate with nitric acid so long as effervescence takes place, or to saturation, filtering, and evaporating the solution. If the solution be heated till all the water is driven off, the ammonium nitrate will form, on cooling, an opaque mass.

$$\underset{\text{Acid Ammonium Carbonate and Carbamate.}}{(NH_4HCO_3)NH_4NH_2CO_2} + \underset{\text{Nitric Acid.}}{3HNO_3} = \underset{\text{Ammonium Nitrate.}}{3NH_4NO_3} + \underset{\text{Carbon Dioxide.}}{2CO_2} + \underset{\text{Water.}}{H_2O}.$$

Ammonium nitrate is found commercially either crystallized, granulated, or in fused masses, and should be kept in well-stoppered bottles.

Ammonii Nitras. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless crystals, generally in the form of long, thin, rhombic prisms, or in fused masses, somewhat deliquescent.	Odorless; sharp, bitter taste; neutral reaction.	At 15° C. (59° F.), 0.5 part.	Cold, 20 parts.
		Boiling, Very soluble.	Boiling, 3 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
When gradually heated, the salt melts at 165°–166° C. (329°–330.8° F.), and at a temperature between 230° and 250° C. (446°–482° F.) it is decomposed into nitrogen monoxide gas and water, leaving no residue. The aqueous solution of the salt, when heated with potassa, evolves vapor of ammonia. On heating the salt with sulphuric acid, it emits nitrous vapors.	Chloride.	A 10-per-cent. aqueous solution of the salt, when acidulated with nitric acid, should not be affected by silver nitrate T.S.
	Sulphate.	A 10-per-cent. aqueous solution, when acidulated with nitric acid, should not be affected by barium chloride T.S.

Uses.—This salt is used largely for preparing nitrogen monoxide (nitrous oxide, or laughing gas) by simply heating the ammonium nitrate and purifying the gas.

$$\underset{\text{Ammonium Nitrate.}}{NH_4NO_3} = \underset{\text{Nitrous Oxide.}}{N_2O} + \underset{\text{Water.}}{2H_2O}.$$

AMMONII VALERIANAS. *U. S.* Ammonium Valerianate.

$NH_4C_5H_9O_2$; 118.78.

Preparation.—This valerianate may be prepared by passing dried gaseous ammonia into monohydrated valerianic acid. The former official process may be used, which is as follows:

Take of Valerianic Acid 4 fl. oz.; Chloride of Ammonium, Lime, each, a sufficient quantity. From a mixture of Chloride of Ammonium, in coarse powder, and an equal weight of Lime, previously slaked and in powder, contained in a suitable vessel, obtain gaseous ammonia, and cause it to pass, first through a bottle filled with pieces of Lime, and afterwards into the Valerianic Acid, in a tall, narrow, glass vessel, until the Acid is neutralized. Then discontinue the process, and set the vessel aside that the Valerianate of Ammonium may crystallize. Lastly, break the salt into pieces, drain it in a glass funnel, dry it on bibulous paper, and keep it in a well-stopped bottle.

The salt which is found in commerce is usually the acid salt: hence, in making a solution of it, as in the process for elixir of ammonium valerianate, the excess of acid should be neutralized by the addition of sufficient ammonia water.

Ammonii Valerianas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Ether.
Colorless, or white, quadrangular plates, deliquescent in moist air. When heated, the salt fuses, gives off vapor of ammonia and of valerianic acid, and is finally dissipated without leaving a residue.	Valerianic acid odor; sharp and sweetish taste; neutral reaction.	Very soluble.	Very soluble.	Soluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution, if gently heated with potassium or sodium hydrate T.S., evolves the odor of ammonia, and, if supersaturated with sulphuric acid, separates an oily layer of valerianic acid on the surface.	Acetate.	If a neutral solution of the salt be completely precipitated with ferric chloride T.S., the filtrate should not possess a deep red color.
	Sulphate.	A 5-per-cent. aqueous solution of the salt, when acidified by nitric acid, should not be affected by barium nitrate T.S.
	Chloride.	The aqueous solution of the salt, when acidified by nitric acid, should not be affected by silver nitrate T.S.

Uses.—Ammonium valerianate is used in hysteria, neuralgia, and similar diseases as a nervine, in doses of five to twenty grains (0.3 to 1.3 Gm.). It is used pharmaceutically in the preparation of an elixir.

SATURATION TABLES. *U. S. 1890.*

Table showing the Quantity of Official Acids required to saturate 100 Parts of an Official Alkali, together with the Quantity of Product.

Alkalies.	Per cent.	Acetic Acid, 36 per cent.	6 per cent.	99 per cent.	Product.	Arsenous Acid, 98.8 per cent.	Product.	Benzoic Acid, 100 per cent.	Product.	Citric Acid, 100 per cent.	Product.	Hydrobromic Acid, 10 per cent.	Product.	Hydrochloric Acid, 31.9 per cent.	10 per cent.	Product.
Ammonium Carbonate	100	318	1909	116	147	191	239	233	265	134	166	1545	187	218	696	102
Ammonia Water	10	98	587	36	45	59	73	72	82	41	51	475	57	67	214	31
Ammonia Water, Stronger	28	274	1642	100	127	165	205	200	228	115	143	1329	161	188	599	88
Potassa	90	267	1604	97	157	161	234	196	343	112	173	1298	191	183	585	120
Solution of Potassa	5	15	89	5	9	9	13	11	19	6	10	72	11	10	32	7
Potassium Bicarbonate	100	166	999	61	98	100	146	122	214	70	108	809	119	114	364	74
Potassium Carbonate	95	229	1375	83	135	138	201	168	294	96	149	1113	164	157	501	103
Soda	90	375	2247	136	306	225	293	274	324	157	268	1819	231	257	819	131
Solution of Soda	5	21	125	8	17	13	16	15	18	9	15	101	13	14	46	7
Sodium Bicarbonate	99	196	1173	71	160	118	153	143	160	82	140	950	121	134	428	69
Sodium Carbonate	99	115	691	42	94	69	90	84	100	48	82	560	71	79	252	40

Alkalies.	Per cent.	Lactic Acid, 75 per cent.	Product.	Nitric Acid, 68 per cent.	10 per cent.	Product.	Phosphoric Acid, 85 per cent.	10 per cent.	Product.	Salicylic Acid, 100 per cent.	Product.	Sulphuric Acid, 92.5 per cent.	10 per cent.	Product.	Tartaric Acid, 100 per cent.	Product.
Ammonium Carbonate	100	229	204	177	1203	153	110	936	126	263	296	101	936	126	143	176
Ammonia Water	10	70	63	54	370	147	34	287	39	81	91	31	288	39	44	54
Ammonia Water, Stronger	28	197	176	152	1035	32	95	805	108	227	255	87	805	109	123	151
Potassa	90	192	205	149	1011	162	92	786	140	221	282	85	786	140	120	189
Solution of Potassa	5	11	11	8	56	9	5	44	8	12	16	5	44	8	7	10
Potassium Bicarbonate	100	120	128	93	630	101	58	490	87	138	176	53	490	87	75	117
Potassium Carbonate	95	165	176	147	867	139	79	674	120	190	242	73	674	120	103	162
Soda	90	270	252	208	1416	191	130	1101	402	310	360	119	1102	362	169	259
Solution of Soda	5	15	14	12	79	11	7	61	22	17	20	7	61	20	9	14
Sodium Bicarbonate	99	141	131	109	740	100	68	575	210	162	188	62	575	189	88	135
Sodium Carbonate	99	83	77	64	436	59	40	339	124	95	111	37	339	111	52	80

Table showing the Quantity of Official Alkalies required to saturate 100 Parts of an Official Acid, together with the Quantity of Product.

Acids.	Per cent.	Ammonium Carbonate, 100 per cent.	Ammonia Water, 10 per cent.	Ammonia Water, 28 per cent.	Product.	Potassa, 90 per cent.	Solution of Potassa, 5 per cent.	Potassium Bicarbonate, 100 per cent.	Potassium Carbonate, 95 per cent.	Product.	Soda, 90 per cent.	Solution of Soda, 5 per cent.	Sodium Bicarbonate, 98.6 per cent.	Sodium Carbonate, 98.9 per cent.	Product.
Acetic	36	31	102	37	46	37	673	60	44	59	27	481	51	87	82
" Diluted	6	5	17	6	8	6	112	10	7	10	4	80	9	14	14
" Glacial	99	86	281	100	127	103	1852	165	120	162	73	1322	141	239	224
Arsenous	98.8	52	170	61	125	62	1119	100	73	146	44	799	85	144	130
Benzoic	100	43	140	50	114	51	920	82	60	176	36	657	70	119	118
Citric	100	75	244	87	124	89	1604	143	104	154	64	1134	122	207	170
Hydrobromic, Diluted	10	6	21	8	12	8	139	12	9	15	6	99	11	18	13
Hydrochloric	31.9	46	149	53	47	55	982	88	64	65	39	701	75	127	51
" Diluted	10	14	47	17	15	17	308	27	20	20	12	220	23	40	16
Lactic	75	44	142	51	89	52	935	83	61	107	37	668	71	121	93
Nitric	68	57	184	66	86	67	1211	108	78	109	48	864	92	156	92
" Diluted	16	8	27	10	13	10	178	16	12	16	7	127	14	23	14
Phosphoric	85	91	296	106	115	108	1946	174	126	151	77	1389	148	251	311
" Diluted	10	11	35	12	13	13	229	20	15	18	9	163	17	30	37
Salicylic	100	38	124	44	112	45	813	73	53	128	32	581	62	105	116
Sulphuric	92.5	99	322	115	125	118	2118	189	137	164	84	1511	161	273	304
" Diluted	10	11	35	12	13	13	229	20	15	18	9	163	17	30	33
Tartaric	100	70	227	81	123	83	1497	133	97	157	59	1068	114	193	153

QUESTIONS ON CHAPTER XLI.

AMMONIUM.

Is ammonium a metal? Has it been isolated?
What is ammonium amalgam?
What are the tests for ammonium salts?
Ammonia—Give formula in symbols and molecular weight.
What is ammonia water?
How much by weight of the gas does it contain?
What is the process by which it was directed to be made in the U. S. Pharmacopœia of 1870? Describe rationale of process.
What is its specific gravity? Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Empyreuma; traces of carbonic acid; sulphate; chloride; metallic impurities; calcium.
What is the dose?
Stronger ammonia water—How much by weight of the gas does this contain?
Give description and specific gravity. What is the dose?
Spirit of ammonia—How much gas does it contain?
How is it made? How may its strength be tested?
Give description and specific gravity. What is the dose?
Aromatic spirit of ammonia—Give Latin official name. How is it made?
Why does this preparation become dark-colored upon being kept? Give description and specific gravity.
Why is precipitation very apt to take place?
What is the object of adding aqua ammoniæ? What is the dose?
What is spirit of Mindererus? Give Latin official name.
How is it made? What is the alternative formula?
Give rationale of process. Which of the formulas is the more satisfactory, and why?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurities of metals be detected? What is the dose?
Ammonium benzoate—Give Latin official name, formula in symbols, and molecular weight.
Describe the process formerly official for making it.
Describe rationale of process.
What is the object of retaining an excess of alkali?
Describe the odor, taste, chemical reaction, and solubility. Give tests for identity. What is the dose?
Ammonium bromide—Give Latin official name, formula in symbols, and molecular weight.
By what different methods may this be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Bromate; iodide; sulphate; more than 3 per cent. of chloride. What is the dose?
Ammonium carbonate—Give Latin official name, formula in symbols, and molecular weight.
Which is the usual process for making this salt? Give rationale of process.
Why is ammonium sulphate preferred to ammonium chloride?
What is official ammonium carbonate, chemically?
If the official salt is exposed to the air, what change takes place?
How may the bicarbonate be converted into carbonate?
What is the principal impurity in the commercial salt, and how may it be detected?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Sulphate; chloride; metals; empyreumatic substances. What is the dose?
Ammonium chloride—Give Latin official name, formula in symbols, and molecular weight.
What is its common or popular name? How is it obtained?
How may it be purified from traces of iron?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Barium; metals; sulphate; iron. What is the dose?

Ammonium iodide—Give Latin official name, formula in symbols, and molecular weight.

Describe the process formerly official by which it may be made.

Give rationale of process.

What is the object of cooling the mixture and adding alcohol?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Sulphate; more than about 0.5 per cent. of chloride and bromide; iron; iodine. What is the dose?

Ammonium nitrate—Give Latin official name, formula in symbols, and molecular weight.

How may it be prepared? Describe rationale of process.

How is it found in commerce?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Chloride; sulphate.

For what is it used? What decomposition takes place?

Ammonium valerianate—Give formula in symbols and molecular weight.

Describe the process formerly official by which it may be prepared.

Why should ammonia water be added to the commercial salt in making solutions of it?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Acetate; sulphate; chloride.

CHAPTER XLII.

MAGNESIUM, CALCIUM, BARIUM, AND STRONTIUM.

Mg; 24.08. Ca; 39.91. Ba; 136.9. Sr; 87.3.

THE compounds of these metals form a natural group. They have numerous physical and chemical characteristics in common. Barium enters into one official salt; some of its compounds are used as tests. Strontium salts were admitted to the U. S. P. 1890, and they are used to a limited extent. Magnesium was formerly classed with the alkaline earths, but it is now usually separated from them, because of its closer chemical analogies to zinc. It is so closely allied to the alkaline earths in its pharmaceutical and medical aspects that it will be most useful to consider it in its former relation.

Magnesium, in the forms of chloride, sulphate, carbonate, magnesia-calcic carbonate, and silicate, is widely distributed. The metal is of a silver-white color, losing its lustre through the oxidation of its surface, and burning with a radiant light when heated to redness, magnesia being formed. The oxide, MgO, is official, and is largely used medicinally.

Tests for Salts of Magnesium.

1. The caustic alkalies produce gelatinous, white precipitates with solutions of magnesium salts, insoluble in excess, but soluble in solution of ammonium chloride.
2. Sodium carbonate or potassium carbonate produces white precipitates with solutions of magnesium salts.
3. Solution of sodium phosphate produces a white crystalline precipitate, on the addition of a small quantity of ammonia water, of ammonio-magnesium phosphate, NH_4,Mg,PO_4.

Official Preparations of Magnesium.

Official Name.	Preparation.
Magnesia	Made by calcining light magnesium carbonate.
Magnesia Ponderosa	Made by calcining heavy magnesium carbonate.
Magnesii Carbonas	Double decomposition between magnesium sulphate and sodium carbonate.
Magnesii Citras Effervescens .	Made from magnesium carbonate, citric acid, sodium bicarbonate, sugar, alcohol, and distilled water.
Magnesii Sulphas	By treating native magnesium hydrate with sulphuric acid.
Liquor Magnesii Citratis . .	By dissolving magnesium carbonate in citric acid, flavoring, and adding potassium bicarbonate.

Unofficial Salts of Magnesium.

Magnesii Acetas, $Mg(C_2H_3O_2)_2$. Magnesium Acetate.	By dissolving magnesium carbonate in sufficient acetic acid, filtering and concentrating, then crystallizing.
Magnesii Iodidum, MgI_2. Magnesium Iodide.	By dissolving magnesia in hydriodic acid, filtering and concentrating, then crystallizing.
Magnesii Lactas, $Mg2C_3H_5O_3.3H_2O$. Magnesium Lactate.	By dissolving separately in hot water 6 p. calcium lactate and 5 p. magnesium sulphate, mixing the solutions and filtering, evaporating the filtrate, then crystallizing.
Magnesii Salicylas. Magnesium Salicylate.	Given in typhoid fever, in daily doses of fifty to one hundred grains continuously.
Magnesii Silicas, $H_2Mg_2Si_3O_9 + H_2O$. Magnesium Silicate.	Occurs in nature as *asbestos*, as meerschaum, and in other forms.
Magnesii Sulphas Exsiccatus, $MgSO_4$. Dried Magnesium Sulphate.	By exposing the crystallized sulphate in a warm place until it has lost 35 per cent. of its weight, then sifting it.
Magnesii Sulphis. Magnesium Sulphite.	By treating magnesia in suspension with sulphurous acid.
Magnesii Sulphocarbolas, $Mg2C_6H_5SO_4.7H_2O$. Magnesium Sulphocarbolate.	By mixing concentrated solutions of barium sulphocarbolate and magnesium carbonate and collecting the precipitate.
Crab Orchard Salt.	A mild saline purgative, consisting mainly of magnesium sulphate, obtained by evaporating the waters of Crab Orchard Springs, Kentucky. Dose, from one to two teaspoonfuls.

MAGNESIA. *U. S.* Magnesia.

MgO; 40.26. [LIGHT MAGNESIA. CALCINED MAGNESIA.]

Preparation.—Magnesium carbonate is exposed in crucibles to a red heat, carbon dioxide and water are expelled, and magnesia is left.

$$\underset{\text{Magnesium Carbonate.}}{(MgCO_3)_4Mg(HO)_2} + \underset{\text{Water.}}{5H_2O} = \underset{\text{Magnesia.}}{5MgO} + \underset{\text{Carbon Dioxide.}}{4CO_2} + \underset{\text{Water.}}{6H_2O}.$$

Magnesia is rendered less soluble if heated too strongly. Magnesia should always be kept in well-closed vessels: exposure to air and moisture causes the formation of carbonate and hydrate.

Magnesia. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, very light, and very fine powder, slowly absorbing moisture and carbon dioxide from the air. Magnesia is not altered or affected by heat, but, when very strongly heated, its density is increased.	Odorless; an earthy but no saline taste; faintly alkaline reaction when moistened with water.	Almost insoluble.	Insoluble.	Soluble in dilute acids.

Tests and Quantitative Tests.	Impurities.	Tests for Impurities.
On stirring 1 part of Magnesia with 15 parts of water, in a beaker, and allowing the mixture to stand for about half an hour, it will form a gelatinous mass of sufficient consistence to prevent it from falling out when the glass is inverted. A filtered solution of Magnesia in diluted sulphuric acid, mixed with ammonium chloride T.S. and an excess of ammonia water, yields, with sodium phosphate T.S., a white, crystalline precipitate.	Limit of Calcium.	This latter solution, when filtered, should not afford more than a slight opalescence with ammonium oxalate T.S.,
	Limit of Sulphate.	Or with barium chloride T.S.,
	Limit of Chloride.	Or, after the addition of a few drops of nitric acid, with silver nitrate T.S.

TESTS.—*Continued.*

TESTS AND QUANTITATIVE TESTS.	IMPURITIES.	TESTS FOR IMPURITIES.
If a mixture of 0.2 Gm. of Magnesia with 10 C.c. of water be heated to boiling, and, after cooling, 5 C.c. of the supernatant liquid be filtered off, this filtrate should not give more than a faintly alkaline reaction with litmus paper, and, when evaporated to dryness, should not leave more than a very slight residue (limit of *foreign soluble salts*).	Absence of Metallic Impurities.	If 0.4 Gm. of Magnesia be dissolved in 10 C.c. of diluted hydrochloric acid, the solution should be colorless, and should not be affected by hydrogen sulphide T.S., nor, after the addition of a slight excess of ammonia water, should it be immediately affected by ammonium sulphide T.S.
The Magnesia mixed with water remaining from the preceding test, when poured into 5 C.c. of acetic acid, should dissolve without the evolution of more than a few isolated gas bubbles (limit of *carbonate*).	Limit of Water of Hydration.	If Magnesia be exposed to a low red heat in a porcelain crucible, it should not lose more than 5 per cent. of its weight.

Uses.—Magnesia is popularly used as a laxative and antacid, in doses of thirty grains (1.9 Gm.). In administering, the magnesia should be added to the diluent, water or milk, and not *vice versa.*

MAGNESIA PONDEROSA. *U. S.* Heavy Magnesia.

MgO; 40.26.

A white, dense, and very fine powder, corresponding in all other properties and reactions with Magnesia. Heavy magnesia is preferable to the ordinary magnesia, on account of its density. This often permits the decrease in bulk of the dose in the ratio of nearly four to one. Magnesia is rendered less bulky by trituration; and if the heavy carbonate is used for the calcination, a heavier powder is produced. The tests and uses of heavy magnesia are the same as those of the light magnesia.

MAGNESII CARBONAS. *U. S.* Magnesium Carbonate.

Approximately $(MgCO_3)_4.Mg(OH)_2 + 5H_2O = 484.62$.

Preparation.—The process of the British Pharmacopœia is as follows: Take of Sulphate of Magnesia 10 ounces [avoirdupois]; Carbonate of Soda 12 ounces [avoird.]; Boiling Distilled Water a sufficiency. Dissolve the Sulphate of Magnesia and Carbonate of Soda, each, in a pint [Imp. Meas.] of the Water, mix the two solutions, and evaporate the whole to perfect dryness, by means of a sand-bath. Digest the residue for half an hour with two pints [Imp. Meas.] of the Water, and, having collected the insoluble matter on a calico filter, wash it repeatedly with Distilled Water, until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding 212° F.

Magnesium carbonate varies in composition somewhat according to the process used. The reaction in making the U. S. carbonate would in its preparation be as follows:

$$\underset{\text{Magnesium Sulphate.}}{5MgSO_4} + \underset{\text{Sodium Carbonate.}}{5Na_2CO_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Magnesium Carbonate.}}{4MgCO_3,Mg(HO)_2} + \underset{\text{Sodium Sulphate.}}{5Na_2SO_4} + \underset{\text{Carbon Dioxide.}}{CO_2}$$

The process for making light magnesium carbonate differs from the above in the substitution of a larger proportion of cold water for the boiling water. This furnishes a good illustration of the rule in precipitation, that dilute solutions produce light precipitates, and dense solutions heavy precipitates.

Magnesii Carbonas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Light, white, friable masses, or a light, white powder, permanent in the air. When strongly heated, it loses water and carbonic acid gas, and is converted into magnesia.	Odorless; slightly earthy taste; feebly alkaline reaction.	Almost insoluble.	Insoluble.	Soluble in dilute acids, with active effervescence.

Tests for Identity.	Impurities.	Tests for Impurities.
A filtered solution of the salt in diluted sulphuric acid, when mixed with ammonium chloride T.S. and an excess of ammonia water, yields, with sodium phosphate T.S., a white, crystalline precipitate.	Limit of Calcium.	A 2-per-cent. solution of the salt, prepared by the addition of acetic acid, should not be rendered more than slightly opalescent by ammonium oxalate,
If the salt be boiled with water, the filtered liquid, when evaporated to dryness, should not leave more than a very slight residue.	Limit of Sulphate.	Nor by barium chloride T.S.,
If 1 Gm. of the salt should be ignited in a porcelain crucible, the residue should weigh not less than 0.4 Gm.	Limit of Chloride.	Nor, after the addition of a few drops of nitric acid, by silver nitrate T.S.
	Metallic Impurities.	If 0.4 Gm. of the salt be dissolved in 5 C.c. of diluted hydrochloric acid, the solution should be colorless, and should not be affected by hydrogen sulphide T.S., nor, after the addition of an excess of ammonia water, should it be immediately affected by ammonium sulphide T.S.

Uses.—Magnesium carbonate is antacid, and in large doses cathartic. The dose is from thirty to sixty grains (1.9 to 3.8 Gm.). It has been largely employed in making medicated waters to assist in diffusing the oils used in preparing them.

MAGNESII CITRAS EFFERVESCENS. *U. S.* **Effervescent Magnesium Citrate.**

[Magnesii Citras Granulatus. *U. S.* 1880.]

	Metric.	Old form.
Magnesium Carbonate	10 Gm.	8 oz. av.
Citric Acid	46 Gm.	13 oz. av. 350 gr.
Sodium Bicarbonate	34 Gm.	10 oz. av. 87 gr.
Sugar, in fine powder	8 Gm.	2 oz. av. 175 gr.
Alcohol,		
Distilled Water, each, a sufficient quantity.		

Mix the Magnesium Carbonate intimately with 30 Gm. [old form 9 oz. av.] of Citric Acid and 4 C.c. [old form 10 fl. dr.] of Distilled Water, so as to form a thick paste. Dry this at a temperature not exceeding 30° C. (86° F.), and reduce it to a fine powder. Then mix it intimately with the Sugar, the Sodium Bicarbonate, and the re-

mainder of the Citric Acid previously reduced to a very fine powder. Dampen the powder with a sufficient quantity of Alcohol, so as to form a mass, and rub it through a No. 6 tinned-iron sieve. Then dry it, and reduce it to a coarse, granular powder.

Keep the product in well-closed vessels.

This official effervescent granular salt is intended to furnish an agreeable, effervescent draught. It is very important to obey the direction to keep it in well-closed bottles, for if access of air be permitted, the moisture will soon cause the acid to act upon the carbonates and liberate the carbonic acid gas gradually, and thus destroy the effervescent character of the draught, which is its principal recommendation.

Magnesii Citras Effervescens. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white, coarsely granular salt, deliquescent on exposure to air.	Odorless; mildly acidulous, refreshing taste; acid reaction.	At 15° C. (59° F.), 2 parts, with copious effervescence. Boiling, Very soluble.	Almost insoluble.

Tests for Identity.	Impurities.	Test for Impurities.
The aqueous solution (1 in 20), after the addition of ammonium chloride T.S. and a slight excess of ammonia water, yields, with sodium phosphate T.S., a white, crystalline precipitate. If to another portion of the aqueous solution a little calcium chloride T.S. be added, and then a slight excess of ammonia water, the filtered liquid will deposit a white precipitate on boiling.	Tartrate.	The saturated aqueous solution of the salt, when mixed with potassium acetate and a small quantity of acetic acid, should not yield a white, crystalline precipitate.

Uses.—Effervescent magnesium citrate is given as a pleasant cathartic, in doses of one to three teaspoonfuls, in cold water.

MAGNESII SULPHAS. *U. S.* Magnesium Sulphate.

$MgSO_4 + 7H_2O = 245.84.$ [Epsom Salt.]

Preparation.—This well-known salt is prepared from a number of mineral substances, but in the United States, principally from a silicious magnesium hydrate, which is practically free from lime. The mineral is reduced to a fine powder and treated with sulphuric acid. The mass is then dried and calcined at a red heat, in order to convert into red oxide any ferrous sulphate which may be present. It is then dissolved in water, and calcium sulphide added to separate any remaining portion of iron. The salt is crystallized and dissolved a third time, in order to purify it.

In England, Epsom salt is sometimes prepared from *dolomite*, the double carbonate of magnesium and calcium, by driving off the carbon dioxide by heat, converting the residue into hydrates, and then treating

these with hydrochloric acid. Calcium chloride is formed, this is dissolved out by washing with water, and the purified magnesia is converted into sulphate by treating it with sulphuric acid.

Magnesii Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Small, colorless, rhombic prisms, or acicular crystals, slowly efflorescent in dry air. When heated to 52° C. (125.6° F.), the salt loses 1 molecule of water, and is converted into a white powder. At about 132° C. (269.6° F.) it still retains 1 molecule of water, and at a temperature of 200° to 238° C. (392° to 460.4° F.) it is rendered anhydrous.	Odorless; cooling, saline, and bitter taste; neutral reaction.	At 15° C. (59° F.), 1.5 parts. Boiling, 0.7 part.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
When mixed with ammonium chloride T.S. and ammonia water, it yields, with sodium phosphate T.S., a white, crystalline precipitate. With barium chloride T.S. it yields a white precipitate insoluble in nitric acid.	Limit of Sodium.	When a small portion of the salt is introduced, on a clean platinum wire, into a non-luminous flame, it should not impart to the latter a persistent yellow color.
	Metallic Impurities.	A 5-per-cent. aqueous solution of the salt should not be affected by hydrogen sulphide T.S.,
	Limit of Chloride.	Nor produce more than a slight opalescence with silver nitrate T.S.,
	Iron, Zinc, or Copper.	Nor should 20 C.c. of the same solution give any coloration or precipitate on the addition of 0.5 C.c. of potassium ferrocyanide T.S.
	Limit of Arsenic.	If 1 Gm. of the powdered salt be shaken with 3 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), a small piece of pure tin-foil added, and the test-tube then set aside, no coloration should appear within one hour.

Uses.—Magnesium sulphate is a valuable refrigerant cathartic, in doses of one ounce (31.1 Gm.); if dissolved in iced water, its nauseous taste is not so perceptible as when water of ordinary temperature is used.

LIQUOR MAGNESII CITRATIS. *U. S.* **Solution of Magnesium Citrate.**

	Metric.	Old form.
Magnesium Carbonate	15 Gm.	231 grains.
Citric Acid	30 Gm.	462 grains.
Syrup of Citric Acid	60 C.c.	2 fl. oz.
Potassium Bicarbonate	2.5 Gm.	39 grains.
Water, a sufficient quantity.		

Dissolve the Citric Acid in 120 C.c. [old form 4 fl. oz.] of Water, and, having added the Magnesium Carbonate, stir, until it is dissolved. Filter the solution into a strong bottle of the capacity of about 360 C.c. [old form 12 fl. oz.], containing the Syrup of Citric Acid. Then add enough Water to nearly fill the bottle, drop in the Potassium Bicarbonate, immediately close the bottle with a cork, and secure it with twine. Lastly, shake the mixture occasionally, until the Potassium Bicarbonate is dissolved.

A few modifications in the manipulation of the official process are advisable. The bulky magnesium carbonate may be replaced by one-

half of the quantity of Jenning's light calcined magnesia. The syrup of citric acid should be introduced into the bottle, and the filtered solution of magnesium citrate very carefully poured in without stirring up the syrup. The potassium bicarbonate, in large crystals, is dropped into the bottle,—they gradually dissolve in the syrup of citric acid,—and the cork is at once inserted, to prevent loss of carbonic acid gas. The bottle is not disturbed until it is called for, when a careful shake mixes the solution of the bicarbonate in the bottom of the bottle with the acid liquid above, liberating the carbonic acid gas, and the solution can then always be dispensed in a sparkling condition.

Uses.—"Solution of citrate of magnesia," as it will probably be always called, is one of the most agreeable cathartics known. It is usually given in the quantity made by the official formula,—twelve fluidounces. The practice of dividing the dose, taking one half three or four hours after the other, is often preferable.

Calcium. Ca; 39.91.

Calcium is a very abundant element, occurring in nature as carbonate, sulphate, phosphate, silicate, chloride, fluoride, etc. It belongs to the class of metals. When heated it burns with a bright light. It is of a light yellow color, and is ductile, like gold; it may be hammered into very thin sheets. It forms but one chloride. The oxide, carbonate, sulphate, phosphate, and hypophosphite are of pharmaceutical interest.

Tests for Salts of Calcium.

1. Alkaline carbonates produce white precipitates with soluble salts of calcium, insoluble in excess.

2. The soluble oxalates (ammonium or potassium oxalate) produce, even in dilute solutions of calcium salts, a white precipitate of calcium oxalate, not soluble in an excess of acetic acid, but soluble in an excess of hydrochloric acid.

Official Preparations of Calcium.

Official Name.	Preparation.
Calx	Made by calcining chalk or limestone.
Calx Chlorata	By treating calcium hydrate with chlorine.
Calx Sulphurata	By heating lime and sulphur to a low red heat.
Calcii Bromidum	By dissolving lime in hydrobromic acid.
Calcii Carbonas Præcipitatus	By double decomposition between calcium chloride and sodium carbonate.
Calcii Chloridum	By acting on calcium carbonate with hydrochloric acid.
Calcii Hypophosphis	By heating phosphorus with milk of lime.
Calcii Phosphas Præcipitatus	By treating bone-ash with HCl, and precipitating with ammonia.
Calcii Sulphas Exsiccatus	By heating calcium sulphate.
Creta Præparata	By elutriating chalk and forming into cones.
Pulvis Cretæ Compositus	Chalk, sugar, gum, etc., for making chalk mixture.
Mistura Cretæ	Compound chalk powder suspended in cinnamon-water and water.
Trochisci Cretæ	Each containing 4 grains of prepared chalk.
Liquor Calcis	By dissolving lime in water.
Linimentum Calcis	Equal parts of lime water and linseed oil.
Syrupus Calcis	A saccharine solution of lime.
Syrupus Calcii Lactophosphatis	A saccharine solution of calcium lactophosphate.

Unofficial Salts of Calcium.

Calcii Benzoas, $Ca(C_7H_5O_2)_2+3H_2O$. Calcium Benzoate.	Made by adding calcium carbonate to a hot aqueous solution of benzoic acid, filtering, evaporating, and crystallizing.
Calcii Hydras, $Ca(HO)_2$. Calcium Hydrate.	By adding 1 p. water to 2 p. lime contained in a metal pot, covering and setting aside to cool, sifting and preserving the fine powder.
Calcii Hyposulphis, $CaS_2O_3 6H_2O$. Calcium Hyposulphite.	Medical properties those of the sulphites. Dose, from ten to twenty grains (0.648 to 1.29 Gm.).
Calcii Iodas, $Ca2IO_3.6H_2O$. Calcium Iodate.	By mixing gradually an alcoholic solution of iodine with excess of filtered aqueous solution of chlorinated lime. After decolorization, slightly acidulating with hydrochloric acid, heating to boiling, filtering, then crystallizing.
Calcii Iodidum, CaI_2, Calcium Iodide.	By dissolving slaked lime in hydriodic acid and concentrating, then crystallizing. Dose, one to four grains (0.06 to 0.2 Gm.).
Calcii Salicylas, $CaC_7H_4O_3 + H_2O$. Calcium Salicylate.	Dose, seven to twenty grains (0.453 to 1.29 Gm.) for diarrhœa and gastro-enteritis.
Calcii Sulphidum, CaS. Calcium Sulphide.	By mixing 12 p. powdered gypsum with 4 p. powdered charcoal, and heating the mixture in a covered crucible until gas ceases to be evolved.
Calcii Sulphas, $CaSO_4.2H_2O$. Calcium Sulphate.	Occurs in nature.
Calcii Sulphis, $CaSO_3$. Calcium Sulphite.	By mixing concentrated solutions of sodium sulphite and calcium chloride and collecting the precipitate.
Calcii Sulphocarbolas, $Ca2C_6H_5SO_4$-$6H_2O$. Calcium Sulphocarbolate.	By mixing concentrated solutions of barium sulphocarbolate and calcium carbonate and collecting the precipitate.
Calcii Sulphydras, CaH_2S_2. Calcium Sulphydrate.	By passing hydrogen sulphide into a mixture of 2 p. slaked lime and 3 p. water as long as absorbed.

CALX. *U. S.* Lime.

CaO; 55.87.

Preparation.—Lime, or calcium oxide, is a very important alkaline earth, and is made by calcining limestone, or native calcium carbonate, in kilns with strong heat: carbon dioxide and water are expelled.

Calx. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Hard, white, or grayish-white masses, gradually attracting moisture and carbon dioxide on exposure to air and falling to a white powder. At the highest heat, lime does not fuse.	Odorless; sharp, caustic taste; alkaline reaction.	At 15° C. (59° F.), 750 parts. Boiling, 1300 parts.	Insoluble.	Soluble in diluted acetic, hydrochloric, or nitric acid.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated to a white heat, Lime is neither fused nor altered. Brought into contact with about half its weight of water, it absorbs the latter, becomes heated, and is gradually converted into a white powder (calcium hydrate or slaked lime). When this is mixed with about 3 or 4 parts of water, it forms a uniform smooth magma (milk of lime).	Carbonate.	If 1 part of Lime be slaked, and then thoroughly mixed with 50 parts of water, and the greater portion of the milky liquid decanted, no hard, gritty particles should be found in the residue, nor should the addition of hydrochloric acid to this residue cause much effervescence, nor leave more than a slight insoluble residue.
Its solution in diluted acetic acid gives, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid.	Barium.	If the decanted portion be dissolved in acetic acid and filtered, if necessary, a portion of the filtrate should not be rendered turbid by potassium dichromate T.S.
	Aluminum.	In another portion of the filtrate, the addition of ammonia water should not produce more than a slight turbidity.

Uses.—Externally, lime acts as an escharotic: it enters into the composition of many depilatory powders; internally, in solution, it is a valuable antacid.

LIQUOR CALCIS. *U. S.* Solution of Lime.

[SOLUTION OF CALCIUM HYDRATE. LIME WATER.]

A saturated, aqueous solution of Calcium Hydrate [$Ca(OH)_2 = 73.83$]. The percentage of Calcium Hydrate varies with the temperature, being somewhat over 0.17 per cent. at 15° C. (59° F.), and diminishing as the temperature rises.

	Metric.	Old form.
Lime	12 Gm.	185 grains.
Distilled Water, a sufficient quantity.		

Slake the Lime by the gradual addition of 70 C.c. [old form 2½ fl. oz.] of Distilled Water, then add 360 C.c. [old form 11½ fl. oz.] more of Distilled Water, and agitate occasionally during half an hour. Allow the mixture to settle, decant the liquid and throw it away. Then add to the residue 3600 C.c. [old form 7½ pints] of Distilled Water, agitate thoroughly, wait a short time for the coarser particles to subside, and pour the liquid, holding the undissolved Lime in suspension, into a glass-stoppered bottle. From time to time shake the bottle, so as to keep the solution saturated. Pour off the clear liquid when it is wanted for use.

Lime water is very extensively used in pharmacy: the object of keeping it upon undissolved Lime is to insure a saturated solution. Lime is but sparingly soluble in water, and less soluble in hot water than in cold: when the solution is heated, a deposition of lime takes place, which is redissolved on cooling. A solution of lime containing particles of undissolved lime in suspension is termed *milk of lime*.

Liquor Calcis. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A clear, colorless liquid. It absorbs carbon dioxide from the air, so that a pellicle of calcium carbonate forms on the surface of the liquid. On being heated, it becomes turbid from separation of calcium hydrate, which redissolves again when the liquid is cooled.	Odorless; saline and feebly caustic taste; strongly alkaline reaction.	Miscible with water and alcohol in all proportions.

Tests for Identity.	Impurities.	Tests for Impurities.
50 C.c. of Solution of Lime should require, for complete neutralization, about 20 C.c. of decinormal oxalic acid V.S. (corresponding to about 0.148 per cent. of Calcium Hydrate), phenolphtalein being used as indicator.	Alkalies and their Carbonates.	The alkaline reaction of the liquid entirely disappears after it has been saturated with carbon dioxide and the excess of the latter has been expelled by boiling.
	In other respects it should conform to the reactions and tests given under Lime (see *Calx*).	

Uses.—Probably the most extensive use of lime water in medicine is in checking nausea. It is usually administered with milk when used for this purpose. It is employed externally to allay inflammation, and

in washes of various kinds. The dose of lime water is from two to four fluidounces (60 to 120 C.c.).

SYRUPUS CALCIS. *U.S.* Syrup of Lime.

A syrupy liquid made by boiling 65 Gm. of lime and 400 Gm. of sugar in 500 C.c. of water, and adding sufficient water to make 1000 C.c. Lime is more soluble in syrup than in water, and hence this syrup is more strongly alkaline than lime water: this is accounted for by the fact that lime forms soluble saccharates with sugar (see page 304).

LINIMENTUM CALCIS. *U.S.* Lime Liniment.

This liniment is made by mixing equal measures of lime water and linseed oil. It is used largely as an external application for burns, and is sometimes called Carron oil (see page 340).

CALX CHLORATA. *U.S.* Chlorinated Lime.'

The activity of this compound depends upon the amount of chlorine present, and it is therefore most appropriately considered under that head (see page 494).

CALX SULPHURATA. *U.S.* Sulphurated Lime.

[CRUDE CALCIUM SULPHIDE.]

A mixture containing at least 60 per cent. of Calcium Monosulphide [$CaS = 71.89$], together with unchanged Calcium Sulphate [$CaSO_4 = 185.78$], and Carbon, in varying proportions.

	Metric.	Old form.
Dried Calcium Sulphate, in fine powder	70 Gm.	7 oz. av.
Charcoal, in fine powder	10 Gm.	1 oz. av.
Starch	2 Gm.	87 grains.

Mix them thoroughly, pack the mixture lightly into a crucible, cover this loosely, and heat it to bright redness, until the contents have lost their black color. Allow the crucible to cool, reduce the product to powder, and at once transfer it to small, glass-stoppered vials.

This is not a definite chemical compound, but contains varying amounts of the active constituent, calcium sulphide,

Calx Sulphurata. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A pale gray powder, gradually altered by exposure to air. On dissolving Sulphurated Lime with the aid of diluted acetic acid, hydrogen sulphide gas is abundantly given off, and a white precipitate, calcium sulphate, is thrown down. The filtrate yields, with ammonium oxalate, a white precipitate, soluble in hydrochloric but insoluble in acetic acid.	Exhaling a faint odor of hydrogen sulphide; offensive alkaline taste; alkaline reaction.	Cold, Very slightly soluble. Boiling, More readily.	Insoluble.

Quantitative Test.
If 1 Gm. of Sulphurated Lime be gradually added to a boiling solution of 2.08 Gm. of cupric sulphate in 50 C.c. of water, the mixture digested on a water-bath for fifteen minutes, and filtered when cold, no color should be imparted to the filtrate by 1 drop of potassium ferrocyanide T.S. (presence of at least 60 per cent. of pure Calcium Monosulphide).

Uses.—Sulphurated lime is used as a depilatory for removing superfluous hair from the body, by mixing a small quantity with water and applying the paste to the part. It is used internally in acne and other skin diseases: the dose is one-half grain to one grain (0.03 to 0.06 Gm.).

CALCII BROMIDUM. *U.S.* Calcium Bromide.

$CaBr_2 = 199.48.$

Preparation.—Calcium bromide may be made by the simple process of adding precipitated calcium carbonate, in excess, to hydrobromic acid, filtering, evaporating the solution to dryness, and granulating the product.

It may also be made by adding milk of lime to a boiling solution of ammonium bromide until ammoniacal vapors cease to be evolved. The solution is then filtered, and the salt granulated.

$$\underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Hydrobromic Acid.}}{2HBr} = \underset{\text{Calcium Bromide.}}{CaBr_2} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

Calcii Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white, granular salt, very deliquescent. At a dull red heat the salt fuses without losing anything but moisture. At a higher temperature it is partially decomposed.	Odorless; sharp, saline taste; neutral reaction.	At 15° C. (59° F.), 0.7 part. Boiling, Very soluble.	Cold, 1 part. Boiling, Very soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
At 680° C. (1256° F.) the salt fuses, and at a higher temperature it is partly decomposed, with loss of bromine.	Bromate.	If diluted sulphuric acid be dropped upon the salt, the latter should not at once assume a yellow color.
An aqueous solution (1 in 20) of the salt yields, with ammonium oxalate T.S., a white precipitate soluble in hydrochloric but insoluble in acetic acid.	Nitrate or Nitrite.	If 1 Gm. of the salt be mixed with 0.5 Gm. of iron filings and 0.5 Gm. of powdered zinc, and heated in a test-tube with 5 C.c. of sodium hydrate T.S., no ammoniacal vapors should be evolved.
If to 5 C.c. of the aqueous solution a few drops of chloroform be added and then 1 C.c. of chlorine water, bromine will be liberated, and, on agitating the mixture, will dissolve in the chloroform with a yellow or brownish-yellow color.	Insoluble Impurities.	If 1 Gm. of the salt be dissolved in 20 C.c. of water, it should form a clear, colorless solution, leaving no residue.
	Arsenic, Lead, etc.	If to 5 C.c. of the above aqueous solution, slightly acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, neither coloration nor turbidity should be perceptible.
	Iron, Aluminum, etc.	The addition of ammonium sulphide T.S. to the aqueous solution should not produce any color or turbidity.

TESTS.—*Continued.*

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If 0.25 Gm. of the well-dried salt be dissolved in 10 C.c. of water and 2 drops of potassium chromate T.S. added, it should require 25 C.c. of decinormal silver nitrate V.S. to produce a permanent red color, corresponding to 99.7 per cent. of the pure salt, a greater amount indicating the presence of *chloride*, a smaller amount *other impurities*.	Magnesium and Alkalies.	If 5 C.c. of the aqueous solution (1 in 20), slightly acidulated with acetic acid, be completely precipitated with ammonium oxalate T.S., the filtrate should, on evaporation, leave not more than a trace of fixed residue.
	Iodide.	If to 5 C.c. of the aqueous solution (1 in 20) a few drops of starch T.S. be added, and then chlorine water, drop by drop, no blue color should appear.
	Sulphate.	No turbidity should be produced if 0.2 C.c. of barium chloride T.S. be added to 5 C.c. of the aqueous solution.

Uses.—Calcium bromide is used as a hypnotic, in doses of thirty to sixty grains (1.9 to 3.8 Gm.).

CALCII CARBONAS PRÆCIPITATUS. *U. S.* Precipitated Calcium Carbonate.

$CaCO_3$; 99.76.

Preparation.—This salt is readily prepared by double decomposition. The following process is official in the British Pharmacopœia:

Take of Chloride of Calcium 5 oz. av.; Carbonate of Soda 13 oz. av.; Boiling Distilled Water a sufficiency. Dissolve the Chloride of Calcium and the Carbonate of Soda each in 2 pints [Imperial measure] of the Water; mix the two Solutions; and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling Distilled Water until the washings cease to give a precipitate with nitrate of silver, and dry the product at the temperature of 212° (F.).

Calcium carbonate precipitates, and sodium chloride remains in solution.

$$\underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Sodium Chloride.}}{2NaCl.}$$

The fineness of the powder is greatly promoted by using hot, dense solutions.

This salt of calcium is also obtained as a by-product in the process for making solution of chlorinated soda, double decomposition taking place between solution of chlorinated lime and solution of sodium carbonate. The precipitated calcium carbonate must be boiled in water, and afterwards thoroughly washed, to free it from the chlorinous odor. The product is unfit for internal use.

Calcii Carbonas Præcipitatus. *U. S.*	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
A fine, white powder, permanent in the air. By exposure to a red heat, with access of air, the salt loses carbon dioxide, and a residue of calcium oxide remains.	Odorless; tasteless.	Nearly insoluble. The solubility is increased by the presence of ammonium salts, and especially by carbonic acid; alkaline hydrates diminish it.	Insoluble.	Wholly soluble in hydrochloric, nitric, or diluted acetic acid, with effervescence.

Test for Identity.	Impurities.	Tests for Impurities.
For applying tests of identity and purity, boil 6 Gm. of Calcium Carbonate with a mixture of 50 C.c. of diluted acetic acid and 50 C.c. of water, allow the liquid to cool, and filter. In this solution, ammonium oxalate T.S. produces a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid.	Magnesium and Alkalies.	If from 20 C.c. of this solution the calcium be completely precipitated by a slight excess of ammonium oxalate T.S., the filtrate should, on evaporation, leave only a trace of fixed residue.
	Sulphate.	If 10 C.c. of the solution be slightly acidulated with acetic acid, no immediate turbidity should be produced by the addition of 0.5 C.c. of barium chloride T.S.
	Chloride.	If to 10 C.c. of the solution, slightly acidulated with nitric acid, 0.1 C.c. of silver nitrate V.S. be added, and the precipitate, if any, removed by filtration, the filtrate should remain perfectly clear upon addition of more silver nitrate V.S.
	Iron, Aluminum, Phosphate, etc.	Addition of ammonia water should not produce any turbidity in the solution.
	Arsenic, Lead, etc.	If to the solution, slightly acidulated with acetic acid, an equal volume of hydrogen sulphide T.S. be added, neither color nor turbidity should be produced.
	Soluble Impurities.	If 1 Gm. of the salt be agitated with 50 C.c. of water, the filtrate should not show an alkaline reaction with litmus paper, and, on evaporation, should not leave more than a trace of residue.

Uses.—This form of calcium carbonate, known popularly as *precipitated chalk*, is largely used in tooth-powders and similar preparations: it is inferior to the prepared chalk as an ingredient in chalk mixtures, because it does not possess the adhesive powers of the latter.

CRETA PRÆPARATA. *U.S.* Prepared Chalk.

Native, friable Carbonate of Calcium [$CaCO_3 = 99.76$], freed from most of its impurities by elutriation.

Preparation.—The process formerly official is as follows:

Take of Chalk *a convenient quantity*. Add a little water to the Chalk, and rub it into fine powder. Throw this into a large vessel nearly full of water, stir briskly, and, after a short interval, decant the supernatant liquor, while yet turbid, into another vessel. Treat the coarser particles of the Chalk, remaining in the first vessel, in a similar manner, and add the turbid liquid to that previously decanted. Lastly, set the liquor by, that the powder may subside, and, having poured off the water, dry the powder.

The object of this process is to effect the separation of the gritty particles in ordinary chalk by elutriation. It is usual to form the moist powder into cones by trochiscation (see page 187). Whilst elutriation effects the purification of the chalk to a certain extent, it does not separate the insoluble fine particles, and hence prepared chalk is chemically not so pure as precipitated carbonate of calcium.

Prepared chalk differs greatly in appearance from precipitated chalk, even after it has been reduced to a fine powder. It is usually not so white as the latter, and it adheres to the fingers when handled. This adhesiveness fits it for many purposes. *Whiting*, a cheap form of prepared chalk, is used for polishing.

Creta Præparata. U.S.	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, amorphous powder, generally agglutinated in the form of small cones, permanent in the air. By exposure to a red heat the salt loses carbon dioxide, and is converted into lime.	Odorless; tasteless.	Almost insoluble.	Insoluble.	Soluble in diluted hydrochloric, nitric, or acetic acid, with copious effervescence, and without leaving more than a trifling residue.

Test for Identity.	Impurities.	Tests for Impurities.
A solution of the salt in diluted acetic acid yields, with ammonium oxalate T.S., a white precipitate soluble in hydrochloric but insoluble in acetic acid.	Barium.	A portion of a neutral solution of the salt in acetic acid should yield no precipitate with potassium dichromate T.S.
	Magnesium.	If from the solution in diluted acetic acid the calcium be completely removed by precipitation with ammonium oxalate T.S. in slight excess, the filtrate should not be rendered very turbid upon addition of sodium phosphate T.S. and a little ammonia water.
	Iron.	A portion of a solution of the salt in acetic acid should not assume more than a slightly bluish tint with a few drops of potassium ferrocyanide T.S.
	Sulphate.	Another portion of the above solution should not be rendered turbid by the addition of barium chloride T.S.

Uses.—This is the form of chalk which is used in medicine almost exclusively; it is an antacid, and is admirably adapted for the treatment of diarrhœa. It is used in the compound chalk powder and in troches of chalk.

CALCII CHLORIDUM. *U. S.* Calcium Chloride.

$CaCl_2 = 110.65.$

Calcium Chloride, rendered anhydrous by fusion at the lowest possible temperature. It should be kept in well-stoppered bottles.

Preparation.—Calcium chloride may be readily formed by saturating hydrochloric acid with chalk or marble, evaporating to dryness, and heating to redness.

$$\underset{\text{Calcium Carbonate.}}{CaCO_3} + \underset{\text{Hydrochloric Acid.}}{2HCl} = \underset{\text{Calcium Chloride.}}{CaCl_2} + \underset{\text{Carbon Dioxide.}}{CO_2} + \underset{\text{Water.}}{H_2O}.$$

It is frequently obtained as a by-product in chemical operations.

Calcii Chloridum. U.S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
White, slightly translucent, hard fragments, very deliquescent. Below a red heat the salt fuses, and, on cooling, solidifies without change in composition; but at a higher temperature, especially if kept in fusion for some time, a portion is decomposed and calcium oxide formed.	Odorless; sharp, saline taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 1.5 parts. Boiling, Very soluble.	Cold, 8 parts. Boiling, 1.5 parts.	Insoluble in ether.

Tests for Identity.	Impurities.	Tests for Impurities.
When perfectly pure, the salt dissolves in water without residue. When the salt is overheated in fusing, the solution has an alkaline reaction, and a small residue is left, which is soluble in hydrochloric acid.	Aluminum, Iron.	The aqueous solution (1 in 20) of the salt should not be precipitated by ammonia water.
The aqueous solution (1 in 20) yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid.	Sulphate.	The aqueous solution (1 in 20) of the salt should not be precipitated by barium chloride T.S.
With silver nitrate T.S. it yields a white precipitate insoluble in nitric acid.	Magnesium and Alkalies.	If from 20 C.c. of the solution the calcium be completely precipitated by ammonium oxalate T.S., the filtrate should, on evaporation, leave not more than a trace of fixed residue.
	Arsenic, Lead.	If 5 C.c. of the aqueous solution, acidulated with hydrochloric acid, be mixed with an equal volume of hydrogen sulphide T.S., neither color nor turbidity should appear.
	Barium.	No turbidity should be produced by the addition of 0.5 C.c. of potassium dichromate T.S. to 5 C.c. of the aqueous solution.

Uses.—Calcium chloride, when in fused masses, is used in chemical operations for dehydrating gases: this it does through its powerful affinity for water.

CALCII HYPOPHOSPHIS. *U. S.* Calcium Hypophosphite.

$Ca(PH_2O_2)_2 = 169.67.$

Preparation.—This salt is made by boiling milk of lime and phosphorus together until the spontaneously inflammable gas, phosphoretted hydrogen, ceases to be evolved: it is necessary to provide for the safe escape of this gas by conducting it by a hood into a powerful draught.

$$\underset{\text{Phosphorus.}}{8P} + \underset{\text{Calcium Hydrate.}}{3CaH_2O_2} + \underset{\text{Water.}}{6H_2O} = \underset{\text{Calcium Hypophosphite.}}{3CaH_4(PO_2)_2} + \underset{\text{Phosphoretted Hydrogen.}}{2PH_3}$$

The liquid is filtered to separate the insoluble phosphate and residuary lime, then concentrated, and refiltered to separate the calcium carbonate formed by the action of the air on a little lime held in solution, and lastly evaporated till a pellicle appears; after which the salt may be allowed to crystallize by setting the liquid aside, or may be obtained in the granular form by continuing the heat, and stirring.

The heat employed in evaporating the solution should not be above 85° C. (185° F.), for fear of explosions, several accidents having occurred through carelessness in this respect, even when the evaporation was conducted with a water-bath.

Calcii Hypophosphis. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, monoclinic prisms, or small, lustrous scales, or a white, crystalline powder, permanent in dry air. When heated in a test-tube, the salt decrepitates, and above 300° C. (572° F.) it begins to decompose, giving off water, and emitting inflammable gases (hydrogen and hydrogen phosphide), and leaving a residue of calcium pyrophosphate and metaphosphate, with some red phosphorus.	Odorless; nauseous, bitter taste; neutral reaction.	At 15° C. (59° F.), 6.8 parts. Boiling, 6 parts.	Insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution (1 in 20) of the salt yields, with ammonium oxalate T.S., a white precipitate soluble in hydrochloric but insoluble in acetic acid.	Phosphate, Sulphate, and other Insoluble Impurities.	If 1 Gm. of the salt be dissolved in 20 C.c. of water, no insoluble residue should be left.
The aqueous solution, slightly acidulated with sulphuric acid, yields, with silver nitrate T.S., a precipitate which is white at first, but rapidly turns brown and black by separation of metallic silver.	Soluble Phosphate.	In the above solution no precipitate should be produced by the addition of lead acetate T.S.,
With copper sulphate T.S., on gentle heating, a reddish-brown precipitate of copper hydride is formed.	Soluble Sulphate.	Nor, after acidulating with hydrochloric acid, by barium chloride T.S.,
When the aqueous solution is added, drop by drop, to mercuric chloride T.S., at first a white precipitate of mercurous chloride is formed, which, as soon as the hypophosphite solution is added in excess, turns gray from reduction to metallic mercury.	Arsenic, etc.	Nor by an equal volume of hydrogen sulphide T.S.
If 0.1 Gm. of the salt be dissolved in 10 C.c. of water, then mixed with 10 C.c. of sulphuric acid and 50 C.c. of decinormal potassium permanganate V.S., and the mixture boiled for fifteen minutes, it should require not more than 3 C.c. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 99.68 per cent. of the pure salt).	Magnesium.	On adding to 5 C.c. of the solution (1 in 20) 1 C.c., each, of ammonium chloride T.S. and ammonia water, and 3 C.c. of ammonium carbonate T.S., applying a gentle heat for a few minutes, and then filtering, not more than a very slight turbidity should be produced upon adding to the filtrate a few drops of sodium phosphate T.S.

Uses.—Calcium hypophosphite is used pharmaceutically to prepare the other hypophosphites and hypophosphorous acid. Medicinally, it is used in phthisis and other wasting diseases, and in cases of defective nerve-nutrition. The dose is from ten to thirty grains (0.65 to 1.9 Gm.).

SYRUPUS HYPOPHOSPHITUM. *U. S.* Syrup of Hypophosphites.

This syrup is made by dissolving 45 Gm. of calcium hypophosphite and 15 Gm. each of sodium and potassium hypophosphites in water, aiding the solution by the use of 2 Gm. of diluted hypophosphorous acid. After the addition of spirit of lemon, the liquid is filtered and sufficient water and sugar are added to make 1000 C.c. of finished syrup (see page 305). There is usually a trifling residue left after dissolving the hypophosphites: this consists generally of insoluble calcium salts. Citric acid is used to dissolve the residue. The citric acid serves also to prevent precipitation in the finished syrup.

SYRUPUS HYPOPHOSPHITUM CUM FERRO. *U. S.* Syrup of Hypophosphites with Iron.

This preparation is made by dissolving 10 Gm. each of ferrous lactate and potassium citrate in enough syrup of hypophosphites to make 1000 C.c. It is used, like the preceding syrup, in phthisis and other wasting diseases, under the belief that the hypophosphites stimulate defective nutrition.

CALCII PHOSPHAS PRÆCIPITATUS. *U. S.* Precipitated Calcium Phosphate.

$Ca_3(PO_4)_2 = 309.38.$

Preparation.—Take of Bone, calcined to whiteness, and in fine powder, 4 oz. troy; Hydrochloric Acid 8 oz. troy; Ammonia Water

12 fl. oz., or a sufficient quantity; Distilled Water, a sufficient quantity. Macerate the Bone in the Acid, diluted with a pint of Distilled Water, until it is dissolved, and filter the solution. Add another pint of Distilled Water, and then, gradually, Ammonia Water, until the liquid acquires an alkaline reaction. Mix the precipitate obtained, while yet in the state of magma, with twice its bulk of boiling Distilled Water, and pour the whole upon a strainer. Wash the precipitate with boiling Distilled Water until the washings cease to be affected by a solution of nitrate of silver, acidulated with nitric acid. Lastly, dry the precipitate with a gentle heat.

Calcium phosphate exists in calcined bone; it is soluble in hydrochloric acid, but is precipitated from its solution by ammonia water, ammonium chloride remaining in solution.

Calcii Phosphas Præcipitatus. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A light, white, amorphous powder, permamanent in the air. At an intense heat it is fusible without decomposition.	Odorless; tasteless.	Almost insoluble. Boiling, Partly decomposed.	Insoluble.	Almost insoluble in acetic acid, except when freshly precipitated. Easily soluble in hydrochloric or nitric acid.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Shake 2 Gm. of the salt with 20 C.c. of the water, and add nitric acid, drop by drop, until solution is effected; then add water to make the liquid measure 40 C.c. From a portion of this solution the salt is precipitated unchanged by a slight excess of ammonia water. From another portion ammonium molybdate T.S. precipitates yellow ammonium phosphomolybdate; the reaction is accelerated by a gentle heat. When moistened with silver nitrate T.S., a yellow color is assumed by the salt either before or after ignition (distinction from *acid calcium phosphate*, which after ignition, when moistened with silver nitrate, remains white).	Carbonate.	Wholly soluble in nitric or in hydrochloric acid without effervescence.
	Aluminum.	The precipitate formed by adding ammonia water to a solution of 1 Gm. of the salt in hydrochloric acid should yield nothing to a boiling solution of potassa.
	Distinction from Acid Calcium Phosphate.	When moistened with silver nitrate T.S., a yellow color is assumed by the salt either before or after ignition, which, after ignition, when moistened with silver nitrate, remains white.
	Chloride.	If to 5 C.c. of the solution, acidulated with nitric acid, 0.5 C.c. of silver nitrate T.S. be added, not more than a slight turbidity should result.
	Sulphate.	The clear solution should not be rendered turbid by barium chloride T.S.,
	Barium.	Nor by potassium sulphate T.S.,
	Arsenic, Lead, etc.	Nor by an equal volume of hydrogen sulphide T.S.,
	Iron.	Nor should it be colored blue by potassium ferrocyanide T.S.
	Magnesium.	If 5 C.c. of the solution be mixed with 1 C.c. of sodium acetate T.S., and then with ammonium oxalate T.S. until the calcium is completely precipitated, the filtrate should not be rendered very turbid by adding ammonia water in slight excess.

Uses.—Precipitated calcium phosphate, on account of its insolubility in water, has been used in making medicated waters in preference to magnesium carbonate and other similar substances. It is administered largely now in proprietary medicines, in combination with lactic acid

and phosphoric acid, in cases of defective nutrition. The dose is from ten to thirty grains (0.6 to 1.9 Gm.).

SYRUPUS CALCII LACTOPHOSPHATIS. *U. S.* **Syrup of Lactophosphate of Calcium.**

This syrup is made by dissolving precipitated calcium carbonate in lactic and phosphoric acids. Water, orange-flower water, and sugar are added to the solution to complete the syrup (see page 303 for the working formula). It is sometimes made extemporaneously by dissolving 200 grains of calcium lactophosphate in one pint of syrup of orange flowers, which contains one fluidrachm of hydrochloric acid. It is given in doses of one to four teaspoonfuls (3.7 to 14.7 C.c.).

CALCII SULPHAS EXSICCATUS. *U. S.* **Dried Calcium Sulphate.**
[DRIED GYPSUM.]

A powder containing about 95 per cent., by weight, of Calcium Sulphate [$CaSO_4$ = 135 73], and about 5 per cent. of Water; prepared from the purer varieties of Native Gypsum [$CaSO_4 + 2H_2O$ = 171.65], by carefully heating until about three-fourths of the water have been expelled. Dried Calcium Sulphate should be kept in well-closed vessels, carefully protected from moisture.

Calcii Sulphas Exsiccatus. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A fine, white powder. From moist air it attracts water, becomes granular, and then loses the property of hardening with water. When mixed with half its weight of water, Dried Calcium Sulphate forms a smooth, cohesive paste, which rapidly hardens.	Odorless and tasteless; neutral reaction.	At 15° C. (59° F.), 410 parts. At 38° C. (100.4° F.), 388 parts. At 100° C. (212° F.), 476 parts.	Insoluble.	It readily dissolves in diluted nitric or hydrochloric acid; also in saturated solutions of potassium nitrate, sodium hyposulphite, and various ammonium salts.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated above 204° C. (399.2° F.), Dried Calcium Sulphate becomes anhydrous and loses the property of forming a paste with water and hardening rapidly. It forms white precipitates with barium chloride T.S., with ammonium oxalate T.S., and with alcohol.	Carbonate.	No effervescence should occur on the addition of diluted acids to Dried Calcium Sulphate.

Uses.—This substance, known commonly as *Plaster of Paris*, is largely used by surgeons in the treatment of fractures, by filling the interstices of a soft-cotton-cloth bandage with the powder and then moistening with water, and applying the bandage to the fractured part in such a way that, when the dried gypsum has hardened, a support is afforded.

PULVIS CRETÆ COMPOSITUS. *U. S.* **Compound Chalk Powder.**

The preparation is made by mixing 30 Gm. of prepared chalk with 20 Gm. of powdered acacia and 50 Gm. of powdered sugar. It is used for making chalk mixture (see Part VI.).

MISTURA CRETÆ. *U. S.* Chalk Mixture.

This mixture is made by rubbing 200 Gm. of compound chalk powder with 400 C.c. of cinnamon water, and adding sufficient water to make 1000 C.c. (see page 317).

TROCHISCI CRETÆ. *U. S.* Troches of Chalk.

Each troche contains nearly four grains of prepared chalk, with acacia, spirit of nutmeg, and sugar (see Part VI.).

Barium. Ba; 136.9.

This element furnishes one salt to the Materia Medica of the Pharmacopœia, and two of its salts are used officially in making test-solutions. *Barium* occurs abundantly as carbonate and sulphate. It is a malleable metal, having a silver-white lustre, decomposes water, and gradually oxidizes in the air.

Tests for Salts of Barium.

1. A soluble barium salt produces with sulphuric acid or soluble sulphate a white precipitate of barium sulphate, which is entirely insoluble in all acids.
2. Barium causes a colorless flame to be colored green.
3. Alkaline carbonates produce white precipitates with soluble barium salts, insoluble in excess.

Official Preparations of Barium.

Preparations.	
Barii Dioxidum.	Used in making solution of hydrogen dioxide.
Test-solution of Barium Chloride.	Used in testing for sulphates.
Test-solution of Barium Nitrate.	Used in testing for sulphates.

Unofficial Salts of Barium.

Barii Acetas, $Ba(C_2H_3O_2)_2$. Barium Acetate.	By decomposing barium carbonate with acetic acid, evaporating, then crystallizing.
Barii Benzoas, $Ba(C_7H_5O_2)_2 + 2H_2O$. Barium Benzoate.	By adding to a solution of barium carbonate benzoic acid until neutralized, then evaporating and crystallizing.
Barii Boras. Barium Borate.	By adding to a solution of barium carbonate a solution of sodium borate, and collecting and drying the precipitate.
Barii Bromidum, $BaBr_2.2H_2O$. Barium Bromide.	By saturating baryta water with hydrobromic acid, evaporating, then crystallizing.
Barii Chloridum, $BaCl_2.2H_2O$. Barium Chloride. (See U. S. P. Test-Solution.)	By dissolving barium carbonate in hydrochloric acid, evaporating, then crystallizing.
Barii Chromas, $BaCrO_4$. Barium Chromate.	By adding to a solution of potassium chromate baryta water, and collecting and drying the precipitate.
Barii Citras, $Ba_3C_6H_5O_7$. Barium Citrate.	By adding citric acid to baryta water in excess, and collecting the precipitate.
Barii Iodidum. Barium Iodide.	Alterative. Dose, one-eighth of a grain three times a day, gradually increased to three grains.
Barii Nitras, $Ba2NO_3$. Barium Nitrate. (See U. S. P. Test-Solution).	By adding to a solution of barium chloride a solution of sodium nitrate, and collecting and drying the precipitate.
Barii Oxalas, $BaC_2O_4.2H_2O$. Barium Oxalate.	By adding a solution of oxalic acid to an excess of baryta water, and collecting the precipitate.
Barii Sulphas, $BaSO_4$. Barium Sulphate.	By adding to a solution of barium chloride sulphuric acid, and collecting the precipitate.

BARII DIOXIDUM. *U. S.* Barium Dioxide.

$BaO_2 = 168.82.$

[BARIUM PEROXIDE.]

Commercial, anhydrous Barium Dioxide. It should be kept in well-closed vessels.

Preparation.—Barium Dioxide (BaO_2) is made by heating barium oxide (BaO) to about 450° C. (874° F.), which causes it to take up another atom of oxygen.

Barii Dioxidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Other Solvents.
A heavy, grayish-white, or pale yellowish-white, amorphous coarse powder.	Odorless and tasteless; alkaline reaction.	Almost insoluble.	Hydrochloric, phosphoric, and other mineral acids decompose it, producing the corresponding Barium salts and hydrogen dioxide, which remain in solution for a considerable time, if the reaction has taken place in the cold and an excess of the acid is present.

Tests for Identity.	Quantitative Test.
When exposed to the air it slowly attracts moisture and carbon dioxide, and is gradually decomposed. When heated to a bright red heat, Barium Dioxide fuses, loses oxygen, and is reduced to barium oxide. Barium Dioxide should be dissolved by diluted hydrochloric or phosphoric acid without leaving more than a trace of residue.	If 2.11 Gm. of Barium Dioxide be dissolved as completely as possible in ice-cold water to the volume of 25 C.c. with the aid of 7.5 C.c. of phosphoric acid, and 5 C.c. of this solution (corresponding to 0.422 Gm. of the Dioxide) be measured off for assay, it should require not less than 40 C.c. of decinormal potassium permanganate V.S. to impart to the liquid a permanent pink tint, corresponding to not less than 80 per cent. of pure Barium Dioxide, each C.c. of the volumetric solution indicating 2 per cent. of the latter.

Uses.—Barium dioxide is used solely for making solution of hydrogen dioxide (see page 290).

Strontium. Sr; 87.3.

Strontium enters into three official salts. It occurs in nature chiefly as sulphate and carbonate. It is a yellow metal, sp. gr. 2.5; malleable, but somewhat harder than lead. Its use in medicine is due to Laborde's demonstration in 1890 that its salts are not poisonous in ordinary doses, but, in certain cases, beneficial.

Tests for Salts of Strontium.

1. A soluble strontium salt produces with alkaline carbonates or with soluble phosphates a white precipitate.
2. Strontium causes a colorless flame to be colored red.
3. Solution of calcium sulphate produces a white precipitate with soluble strontium salts. Slow precipitation is hastened by the addition of alcohol.

Official Salts of Strontium.

Strontii Bromidum . . . Strontium Bromide.	Made by dissolving strontium carbonate in hydrobromic acid.
Strontii Iodidum . . . . Strontium Iodide.	Made by evaporating a solution of strontium hydrate in hydriodic acid.
Strontii Lactas . . . . Strontium Lactate.	Made by dissolving freshly precipitated strontium carbonate in lactic acid.

Unofficial Salts of Strontium.

Strontii Carbonas, $SrCO_3$. Strontium Carbonate.	Occurs native as strontianite.
Strontii Chloridum, $SrCl_2$. Strontium Chloride.	Made by treating strontianite (native carbonate) with hot hydrochloric acid.
Strontii Chromas, $SrCrO_4$. Strontium Chromate.	Made by precipitating a strong solution of chloride or nitrate with neutral potassium chromate.
Strontii Hydras, $Sr(OH)_2$. Strontium Hydrate.	Obtained by treating the oxide with water.
Strontii Nitras, $Sr(NO_3)_2$. Strontium Nitrate.	By treating the carbonate with diluted nitric acid, evaporating, and crystallizing.
Strontii Oxidum, SrO. Strontium Oxide.	Obtained by heating the nitrate to redness or igniting the carbonate.
Strontii Sulphas, $SrSO_4$. Strontium Sulphate.	Occurs native as celestine.

STRONTII BROMIDUM. *U. S.* Strontium Bromide.

$$SrBr_2 + 6H_2O = 354.58.$$

Strontium Bromide should be kept in glass-stoppered vials.

This salt may be made in several ways, but the simplest method is to dissolve strontium carbonate in hydrobromic acid and then evaporate and crystallize the salt from the solution.

Strontii Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvent.
Colorless, transparent, hexagonal crystals, very deliquescent. When heated, the crystals at first melt, and then lose all their water (30.4 per cent.). The anhydrous salt fuses at 630° C. (1166° F.).	Odorless; bitter, saline taste; neutral reaction.	At 15° C. (59° F.), 1.5 parts. Boiling, 0.5 part.	Readily soluble.	Insoluble in ether.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
To a non-luminous flame the salt communicates an intensely red color. With calcium sulphate T.S. the aqueous solution (1 in 20) slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids; the same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., and other soluble sulphates. With potassium chromate T.S. it forms a yellow precipitate of strontium chromate, soluble in acetic acid. With ammonium carbonate T.S., or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If a few drops of chloroform be added to 5 C.c. of the solution, then 1 C.c. of chlorine water, and the mixture shaken, the liberated bromine will dissolve in the chloroform, communicating to it a yellow or brownish-yellow color.	Arsenic, Lead, Copper, etc.	The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S. either before or after acidulation with a drop of hydrochloric acid,
	Iron, Aluminum, etc.	Nor by ammonium sulphide T.S.
	Barium.	It should form no precipitate with potassium dichromate T.S.
	Iodine.	If a few drops of starch T.S. be mixed with 5 C.c. of the aqueous solution, and then one or two drops of chlorine water added, no blue color should appear.
	Limit of Chloride.	If 0.3 Gm. of Strontium Bromide, previously rendered anhydrous by thorough drying, be dissolved in 10 C.c. of water, and 3 drops of potassium dichromate be added, it should require not more than 24.6 C.c. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 98 per cent. of the pure salt).

Uses.—Strontium bromide is used in place of potassium and sodium bromides in epilepsy. Dose, twenty to sixty grains (1.3 to 3.8 Gm.).

STRONTII IODIDUM. *U. S.* Strontium Iodide.

$SrI_2 + 6H_2O = 448.12.$

Strontium Iodide should be kept in dark amber-colored, glass-stoppered vials.

This salt may be made by evaporating a solution of strontium hydrate in hydriodic acid.

Strontii Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Colorless, transparent, hexagonal plates, deliquescent, and easily colored yellow by exposure to air and light. When cautiously heated, the crystals melt and gradually lose their water (24.05 per cent.), becoming anhydrous. At a red heat it is decomposed, losing iodine, and leaving a residue of strontium oxide.	Odorless; bitterish, saline taste; neutral or very slightly acid reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.27 part.	Soluble.	Slightly soluble in ether.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
To a non-luminous flame it communicates an intensely red color. With calcium sulphate T.S. it slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids; the same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., or other soluble sulphates. With potassium chromate T.S. it forms a yellow precipitate of strontium chromate, soluble in acetic acid.	Arsenic, Lead, Copper, etc.	The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S., either before or after acidulation with a drop of hydrochloric acid,
	Iron, Aluminum, etc.	Nor by ammonium sulphide T.S.
	Barium.	No turbidity should be produced in the aqueous solution by potassium dichromate T.S.
With ammonium carbonate T.S., or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If a few drops of starch T.S. be added to 5 C.c. of the solution, and then 1 C.c. of chlorine water, a bluish-black color will appear.	Limit of Chloride.	If 0.3 Gm. of Strontium Iodide, previously rendered anhydrous by thorough drying, be dissolved in 10 C.c. of water and 3 drops of potassium dichromate T.S. be added, it should require not more than 18 C.c. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 98 per cent. of the pure salt).

Uses.—This salt has been introduced into the U. S. P. 1890 as a substitute for potassium iodide, as it is believed to be less irritating to the intestinal tract, or less depressing to the general nutrition. Dose, ten to twenty grains (0.6 to 1.3 Gm.).

STRONTII LACTAS. *U. S.* Strontium Lactate.

$Sr(C_3H_5O_3)_2 + 3H_2O = 318.76.$

This salt may be made by dissolving freshly-precipitated strontium carbonate in lactic acid, filtering, evaporating, and granulating.

Strontii Lactas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A white, granular powder, or crystalline nodules, permanent in the air. The solution, saturated at a boiling heat, remains liquid for many hours, even after being cooled to 0° C. (32° F.). When heated to 110° C. (230° F.), the salt loses its water (16.9 per cent.). At a higher temperature it first fuses, then is decomposed, giving off inflammable vapors, and leaves a residue of strontium carbonate and carbon, which, on the addition of hydrochloric acid, effervesces and communicates an intensely red color to a non-luminous flame.	Odorless; slightly bitter, saline taste; slightly acid reaction.	At 15° C. (59° F.), 4 parts. Boiling, Less than 0.5 part.	Soluble.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
With calcium sulphate T.S. the solution slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids. The same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., or other soluble sulphates. With potassium chromate T.S. it forms a yellow precipitate of strontium chromate, soluble in acetic acid. With ammonium carbonate T.S., or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If to 5 C.c. of the solution (1 in 20) 1 C.c. of sulphuric acid be added, and then 1 C.c. of decinormal potassium permanganate V.S., the red color will rapidly disappear, while the mixture will effervesce and give off the odor of aldehyde. If 1.33 Gm. of the salt, previously rendered anhydrous by careful drying at 110° C. (230° F.), be ignited, until most of the carbon has disappeared, and then distributed in 10 C.c. of water, it should require, for complete neutralization, not less than 9.9 C.c. of normal sulphuric acid (corresponding to at least 98.6 per cent. of the pure salt), methyl-orange being used as indicator.	Carbonate, Oxalate, etc.	If 1 Gm. of the salt be dissolved in 19 C.c. of water, it should form a perfectly clear, colorless solution, leaving no insoluble residue.
	Arsenic, Lead, etc.	The aqueous solution should not be affected by hydrogen sulphide T.S., either before or after acidulation with a drop of hydrochloric acid,
	Iron, Aluminum, etc.	Nor by ammonium sulphide T.S.
	Barium.	No turbidity should be produced in the solution by potassium dichromate T.S.
	Limit of Chloride, etc.	If 0.5 C.c. of silver nitrate T.S. be added to 5 C.c. of the aqueous solution, not more than a slight opalescence should be perceptible.
	Carbonate, Oxalate, etc.	If 0.5 Gm. of the salt be placed upon a watch-glass, and 1 C.c. of sulphuric acid be carefully poured upon it, no effervescence should occur,
	Butyrate, Propionate, etc.	Nor should any penetrating odor be perceptible, even after gentle heating,
	Limit of Readily Carbonizable Organic Impurities.	Nor should the acid assume, within ten minutes, a deeper color than a pale straw-yellow.

Uses.—This salt is recommended in the treatment of nephritis, rheumatism, gout, etc., in doses of ten to thirty grains (0.6 to 1.9 Gm.).

QUESTIONS ON CHAPTER XLII.

MAGNESIUM, CALCIUM, BARIUM, STRONTIUM.

Magnesium—Give formula in symbols and molecular weight.
How is it found?
What are the tests for the salts of magnesium?
Magnesia—Give formula in symbols and molecular weight.
How is it prepared? Describe rationale of process.
What change takes place on exposure to air and moisture?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Carbonate; more than traces of other alkaline earths; sulphates; chloride.
What is the dose?
Magnesia ponderosa—Wherein does this differ from magnesia?
Magnesium carbonate—Give formula in symbols and molecular weight.
What is the process of the British Pharmacopœia for making this?
Describe rationale of process. How may light magnesium carbonate be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Aluminum, or more than traces of calcium; metals; limit of sulphate; chloride.
What is the dose?
Effervescent magnesium citrate—Give Latin official name.
How is it prepared, and what is the object of this preparation?
If exposed to the air, what change takes place?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of tartrate be detected?
What is the dose?
Magnesium sulphate—Give formula in symbols and molecular weight.
How is this salt obtained in the United States?
How is it sometimes prepared in England?
How much water of crystallization does it contain?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Metals; alkaline earths; chloride; more than about 1 per cent. of sulphate of alkalies.
What is the dose?
Solution of magnesium citrate—Give Latin official name.
How is it prepared?
What modifications of the official process are advisable?
What is the dose?
How much magnesia does each troche of magnesia contain?
Calcium—Give symbol and atomic weight.
In what forms does calcium occur?
What are its physical properties?
What are the tests for salts of calcium?
Lime—Give formula in symbols and molecular weight.
How is it obtained?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Carbonate; insoluble matter.
What is the dose?
Lime water—Give Latin official name.
How is it made?
How much calcium hydrate does it contain?
Give formula in symbols and molecular weight of calcium hydrate.
Is lime more soluble in hot or in cold water?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurities of alkalies or their carbonates be detected? What is the dose?
How is syrup of lime made?
What is the object of making a syrup of lime?
What is lime liniment? What is a popular name for it?
For what purpose is it used?

Chlorinated lime—Give Latin official name.
Upon what does the activity of this compound depend?
What is sulphurated lime? How is it made?
How much calcium sulphide should it contain? How may this be tested?
Describe odor, taste, chemical reaction, and solubility. What is the dose?
Calcium bromide—Give formula in symbols and molecular weight.
In what two ways may this preparation be made?
Explain the reaction which takes place between milk of lime and solution of ammonium bromide when mixed.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Bromate; iodide; sulphate; chloride; magnesium. What is the dose?
Precipitated calcium carbonate—Give the British official process for making it.
How may the fineness of the powder be promoted?
In what process is this salt obtained as a by-product?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Magnesium; aluminum, iron, or phosphate. What is the dose?
Which is preferred for chalk mixtures—this, or prepared chalk, and why?
What is prepared chalk?
What is the process for making it (formerly official)?
What is the object of this process?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Barium or strontium; magnesium; iron.
For what is it used, and into what official preparation does it enter?
What is whiting, and for what is it used?
Calcium chloride—Give formula in symbols and molecular weight.
How may this salt be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Aluminum or iron; sulphate; magnesium.
For what purpose is it used?
Calcium hypophosphite—Give Latin name, formula in symbols, and molecular weight.
How is this salt prepared? Describe rationale of process.
What temperature should be employed in evaporating the solution?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Insoluble calcium salts; soluble phosphate; soluble sulphate; magnesium. What is the dose?
How is syrup of hypophosphites made?
What is the object of using citric acid?
How is syrup of hypophosphites with iron made?
Precipitated calcium phosphate—Give Latin name, formula in symbols, and molecular weight.
How is it prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Carbonate; aluminum.
What is the dose?
Give the Latin name of dried calcium sulphate. What is its common name or synonyme? How is it prepared? What is its composition?
Syrup of calcium lactophosphate—Give Latin official name.
How is it made? What is the dose?
Compound chalk powder—Give Latin official name.
How is it made? For what is it used?
How is chalk mixture made?
What is the composition of troches of chalk?
Barium—Give symbol and atomic weight.
What salts of barium are used officially, and for what?
How is it found in nature?
What are the tests for salts of barium?
Strontium—Give symbol and atomic weight.
What salts of strontium are used officially, and for what?
By what tests may strontium salts be recognized?

CHAPTER XLIII.

ZINC, ALUMINUM, CERIUM, AND CADMIUM.

Zn; 65.1. Al; 27.04. Ce; 139.9. Cd; 111.5.

THESE metals are grouped together on account of the similarity in some of their physical properties, rather than because of the chemical analogies existing between them.

ZINCUM. *U.S.* Zinc.

Zn; 65.10.

Metallic Zinc, in the form of thin sheets, or irregular, granulated pieces.

Preparation.—Zinc is made by roasting *calamine*, or the impure zinc carbonate, with charcoal, in powder, and collecting the zinc by distillation, the vapors being conducted into water, where the zinc is condensed. It is bivalent, and combines with oxygen, chlorine, and phosphorus, forming zinc oxide, chloride, and phosphide, and with numerous acids to form salts.

Tests for Zinc Salts.

1. Ammonium sulphide, if added to a solution of a zinc salt containing an excess of alkaline hydrate, produces a characteristic white precipitate of zinc sulphide.

2. The alkaline hydrates of either sodium, potassium, or ammonium produce white precipitates of zinc hydrate, freely soluble in an excess of alkali.

3. Sodium and potassium carbonates yield white precipitates, insoluble in an excess.

4. The zinc salts are all colorless.

Zincum. *U.S.*	Impurities.	Tests for Impurities.
A bluish-white metal, showing a crystalline fracture, and having a specific gravity ranging from 6.9 when it is cast, to 7.2 after it is rolled. Soluble in diluted sulphuric or hydrochloric acid, with evolution of hydrogen gas.	Sulphur.	When Zinc is dissolved in diluted hydrochloric acid, the hydrogen gas which is evolved should not have any disagreeable odor, nor should it color a strip of paper moistened with lead acetate T.S.
When heated above 100° C. (212° F.), and not above 150° C. (302° F.), the metal becomes malleable and ductile;	Arsenic, Antimony, Phosphorus.	Or with silver nitrate T.S.
above 200° C. (392° F.) it becomes sufficiently brittle to be powdered in an iron mortar; at 412° to 415° C. (773.6° to 779° F.) it melts, and at 940° C. (1724° F.) it boils and may be readily distilled.	Arsenic, Cadmium, Lead, Copper, etc.	If an equal volume of hydrogen sulphide T.S. be added to the solution, neither color nor turbidity should be perceptible.
The solution should be clear and colorless, and should not yield a pure white precipitate with potassium ferrocyanide T.S., and with ammonium sulphide T.S.	Iron, Lead, Copper, etc.	If ammonia water be added to the solution, a white precipitate should form, which should redissolve completely in an excess of the reagent, yielding a clear, colorless solution.

Uses.—Zinc is used in making hydrogen and in preparing the zinc salts.

Zinc and Official Preparations.

Official Name.	Preparations.
Zincum	Made by roasting the impure carbonate with charcoal and distilling.
Zinci Acetas	By treating zinc carbonate with acetic acid.
Zinci Bromidum	By double decomposition of zinc sulphate and potassium bromide.
Zinci Carbonas Præcipitatus	By double decomposition of zinc sulphate and sodium carbonate.
Zinci Chloridum	By evaporating the solution of zinc chloride.
Liquor Zinci Chloridi	By treating zinc with hydrochloric acid.
Zinci Iodidum	By digesting zinc with iodine diffused in water.
Zinci Oxidum	By calcining zinc carbonate.
Unguentum Zinci Oxidi	By incorporating zinc oxide with benzoinated lard.
Zinci Phosphidum	By passing vapors of phosphorus over fused zinc in a current of dry hydrogen.
Zinci Sulphas	By acting on zinc with diluted sulphuric acid.
Zinci Valerianas	By double decomposition of zinc sulphate and sodium valerianate.
Oleatum Zinci	By sifting zinc oxide upon oleic acid and heating gently until dissolved.

Unofficial Salts of Zinc.

Zinci Cyanidum, $Zn(CN)_2$. Zinc Cyanide.	By adding hydrocyanic acid to a solution of zinc acetate and collecting the precipitate.
Zinci et Potassii Cyanidum, K_2ZnCy_4. Zinc and Potassium Cyanide.	By dissolving zinc cyanide in a solution of pure potassium cyanide, filtering, concentrating, then crystallizing.
Zinci Ferrocyanidum, $Zn_4(C_3N_3)_4Fe_2$. Zinc Ferrocyanide.	By making a solution of zinc sulphate and one of potassium ferrocyanide, mixing them, and collecting the precipitate.
Zinci Lactas, $Zn(C_3H_5O_3)_2.3H_2O$. Zinc Lactate.	Dissolving, by the aid of heat, zinc carbonate in diluted lactic acid, filtering and concentrating, then crystallizing.
Zinci Salicylas, $Zn(C_7H_5O_3)_2.3H_2O$. Zinc Salicylate.	By heating salicylic acid with distilled water, gradually adding zinc oxide suspended in water, until no longer dissolved, filtering, and then crystallizing.
Zinci Sulphocarbolas, $Zn(C_6H_5SO_4)_2.8H_2O$. Zinc Sulphocarbolate.	By mixing concentrated solutions of barium sulphocarbolate and zinc carbonate and collecting the precipitate.
Zinci Tartras. Zinc Tartrate.	By mixing hot concentrated solutions of zinc sulphate and neutral potassium tartrate, collecting the precipitate, and drying it.

ZINCI ACETAS. *U. S.* Zinc Acetate.

$$Zn(C_2H_3O_2)_2 + 2H_2O = 218.74.$$

Preparation.—This salt may be made by the former official process: Take of Commercial Oxide of Zinc 2 oz. troy; Acetic Acid 8½ fl. oz.; Distilled Water 5 fl. oz. Mix the Acid and Water, and digest the Oxide of Zinc in the mixture for half an hour, then heat to the boiling point, filter while hot, and set aside to crystallize. Drain the crystals in a funnel, and dry them upon bibulous paper. An additional quantity of crystals may be obtained by evaporating the mother-liquor to one-half, slightly acidulating with acetic acid, and crystallizing.

The reaction is expressed as follows:

$$\underset{\text{Zinc Oxide.}}{ZnO} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Zinc Acetate.}}{Zn(C_2H_3O_2)_2} + \underset{\text{Water.}}{H_2O}.$$

Zinci Acetas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Soft, white, six-sided, monoclinic plates, of a pearly lustre, somewhat efflorescent in dry air, losing some of its acid. When heated, the salt is partially fused, losing water and acid. At a higher temperature it is decomposed, evolving acetone and other combustible vapors, and leaving a residue of zinc oxide.	Faintly acetous odor; astringent, metallic taste; acid reaction.	At 15° C. (59° F.), 2.7 parts. Boiling, 1.5 parts.	At 15° C. (59° F.), 36 parts. Boiling, 3 parts.

Tests for Identity.	Impurities.	Tests for Impurities.
In the aqueous solution (1 in 20) of the salt, hydrogen sulphide T.S., as well as ammonium sulphide T.S., produces a pure white precipitate; potassium ferrocyanide T.S. also causes a white precipitate. Potassium hydrate T.S., or ammonium carbonate T.S., when added in small quantity, produces a white precipitate, which dissolves upon the addition of an excess of the reagent. The addition of a little ferric chloride T.S. produces a red color. The aqueous solution of the salt yields a white precipitate with test-solution of potassium ferrocyanide or of ammonium sulphide. On heating the salt with sulphuric acid, acetous vapors are evolved.	Arsenic, Cadmium, Lead, Copper, etc.	The aqueous solution (1 in 20), acidulated with hydrochloric acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S.
	Aluminum, Iron, Alkalies, Alkaline Earths.	If the aqueous solution be completely precipitated by hydrogen sulphide T.S. (without having been acidulated), the filtrate should, after evaporation, leave no fixed residue.
	Sulphate.	The aqueous solution should remain perfectly clear after the addition of either barium chloride T.S.
	Chloride.	Or silver nitrate T.S.

Uses.—Zinc acetate is used principally as a local remedy, in eye-washes, injections, etc.

ZINCI BROMIDUM. *U. S.* Zinc Bromide.

$ZnBr_2$; 224.62.

Preparation.—Zinc bromide may be made by the process suggested by Lyons, of dissolving potassium bromide and crystallized zinc sulphate, each, in the smallest quantity of hot water, and mixing while hot. When the mixture has cooled, twice its bulk of alcohol is added, and the whole filtered through asbestos to separate the potassium sulphate. The filtrate is evaporated to dryness, and the residue granulated.

This salt may also be made by adding bromine to water and dropping in *mossy zinc*, a form of metallic zinc made by pouring the pure melted metal in water (the pieces bear some resemblance to moss); zinc bromide remains in solution, and may be obtained by filtration, evaporation, and granulation.

$$\underset{\text{Zinc Sulphate.}}{ZnSO_4} + \underset{\text{Potassium Bromide.}}{2KBr} = \underset{\text{Zinc Bromide.}}{ZnBr_2} + \underset{\text{Potassium Sulphate.}}{K_2SO_4}.$$

Zinci Bromidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white, granular powder, very deliquescent. When heated to 394° C. (741.2° F.), the salt fuses, and, with careful increase of heat, may be sublimed in the form of needle-shaped prisms.	Odorless; sharp, saline, and metallic taste; slightly acid reaction.	Readily soluble.	Readily soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
A 5-per-cent. aqueous solution of the salt yields a pure white precipitate with hydrogen sulphide T.S., ammonium sulphide T.S., or potassium ferrocyanide T.S. Silver nitrate T.S. produces a yellowish-white precipitate insoluble in ammonia water. If a few drops of copper sulphate T.S. be mixed with 5 C.c. of the aqueous solution (1 in 20) of Zinc Bromide, and then some sulphuric acid be carefully poured into the mixture so as to form a separate layer, a deep brownish-red color will appear at the line of contact, and will disappear when the mixture is shaken.	Iodine.	If to the aqueous solution (1 in 20) a little starch T.S. be added, and then some chlorine water, drop by drop, the liquid should assume a pure yellow color, free from any shade of blue.
If 0.3 Gm. of the dry salt be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should require 26.7 C.c. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to not less than 99.95 per cent. of the pure salt).	Arsenic, Cadmium, Lead, Copper, etc.	After acidulation with hydrochloric acid, the aqueous solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S.
	Iron, Aluminum, Calcium, etc.	On adding ammonium carbonate T.S. to the aqueous solution of Zinc Bromide, a white precipitate is produced which should completely redissolve in an excess of the reagent.
	Alkalies, Magnesium, etc.	If from this solution in ammonium carbonate T.S. all the zinc be precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation.

Uses.—Zinc bromide is used medicinally as a hypnotic, in doses of five grains (0.3 Gm.).

ZINCI CARBONAS PRÆCIPITATUS. *U.S.* Precipitated Zinc Carbonate.

Preparation.—This salt may be made by the British process, as follows:

Take of Sulphate of Zinc 10 oz. av.; Carbonate of Soda 10½ oz. av.; Boiling Distilled Water a sufficiency. Dissolve the Carbonate of Soda with a pint [Imperial measure] of the Water in a capacious porcelain vessel, and pour into it the Sulphate of Zinc also dissolved in a pint [Imp. meas.] of the Water, stirring diligently. Boil for fifteen minutes after effervescence has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate 3 pints of boiling Distilled Water, agitating briskly; let the precipitate again subside; and repeat the process of effusion of hot Distilled Water and subsidence, till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat.

$$\underset{\text{Sodium Carbonate.}}{5Na_2CO_3} + \underset{\text{Zinc Sulphate.}}{5ZnSO_4} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Zinc Carbonate.}}{(ZnCO_3)_2 3Zn(HO)_2} + \underset{\text{Sodium Sulphate.}}{5Na_2SO_4} + \underset{\text{Carbon Dioxide.}}{3CO_2}.$$

If cold solutions of zinc sulphate and sodium carbonate are mixed together, neutral zinc carbonate is precipitated. This carbonate quickly decomposes, carbon dioxide being evolved, which, upon escaping, makes a portion of the precipitate soluble. This loss is prevented by conducting the precipitation at the boiling temperature, whereby the carbon dioxide is driven off as quickly as it is formed, and solution is thereby prevented.

Zinci Carbonas Præcipitatus. U. S.	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, impalpable powder, of somewhat variable chemical composition, permanent in the air. When strongly heated, the salt loses water and carbon dioxide, and leaves a residue of zinc oxide, which is yellow while hot, but becomes white on cooling.	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in diluted acids with copious effervescence. Soluble in ammonia water, and in ammonium carbonate T.S.

Tests for Identity.	Impurities.	Tests for Impurities.
When a small portion of the salt is moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid green color. For making tests of identity and purity, add 10 C.c. of diluted sulphuric acid and 10 C.c. of water to 1.25 Gm. of the salt, and, after effervescence has ceased, remove the undissolved excess by filtration. In a portion of the filtrate a pure white precipitate is produced by potassium ferrocyanide T.S., or by ammonium sulphide T.S.	Arsenic, Cadmium, Lead, Copper, etc.	In another portion of the filtrate, acidulated with hydrochloric acid, no color or turbidity should be produced by the addition of an equal volume of hydrogen sulphide T.S.
	Iron, Aluminum, Calcium, etc.	Another portion of the filtrate should yield with ammonium carbonate T.S. a white precipitate, which should redissolve completely in an excess of the reagent.
	Lead.	No insoluble residue should be left, if 0.5 Gm. of Zinc Carbonate be dissolved in 10 C.c. of diluted sulphuric acid.
	Limit of Alkali.	If 1 Gm. of the salt be placed in a flask with 10 C.c. of boiling water, and 2 drops of phenolphtalein T.S. be added, not more than 1 C.c. of decinormal oxalic acid V.S. should be required to discharge the red color.

Uses.—Precipitated zinc carbonate is used principally in ointments, and takes the place of the former impure carbonate termed *calamine.* It is sometimes dusted upon inflamed surfaces as an astringent and absorbent.

ZINCI CHLORIDUM. *U. S.* Zinc Chloride.

$ZnCl_2$; 135.84.

Preparation.—Zinc chloride is easily prepared by digesting metallic zinc in hydrochloric acid and evaporating the solution to dryness; or, preferably, by evaporating the official solution of zinc chloride.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Zinc Chloride.}}{2ZnCl_2} + \underset{\text{Hydrogen.}}{4H.}$$

Zinci Chloridum. U. S.	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white, granular powder, or porcelain-like masses, irregular, or moulded into pencils. Very deliquescent. The salt should be dissolved in much water for tasting. When heated to 115° C. (239° F.), it fuses to a clear liquid. At a higher temperature it is partly volatilized in dense, white fumes, and partly decomposed, leaving a residue of zinc oxide.	Odorless; very caustic, astringent, and metallic taste; acid reaction.	At 15° C. (59° F.), 0.3 part, forming a clear solution, which, on protracted boiling, deposits a basic salt.	Very soluble.

TESTS FOR IDENTITY.	IMPURITIES.	TESTS FOR IMPURITIES.
A 5-per-cent. aqueous solution of the salt yields, with potassium ferrocyanide T.S., a pure white precipitate, and with ammonium carbonate T.S. a white precipitate, which redissolves in an excess of the reagent.	Limit of Oxychloride.	The aqueous solution (1 in 20) should be clear, or at most only very slightly opalescent; and, if it be mixed with an equal volume of alcohol, a single drop of hydrochloric acid should suffice to render 10 C.c. of the mixture perfectly clear.
Silver nitrate T.S. produces a white precipitate insoluble in nitric acid.	Arsenic, Cadmium, Lead, Copper, etc.	If to the aqueous solution, acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, it should not become colored or turbid.
If 0.3 Gm. of dry Zinc Chloride be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, it should require 44.1 C.c. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to not less than 99.84 per cent. of the pure salt).	Iron, Aluminum, Calcium, etc.	If ammonium carbonate T.S. be added to the solution, the precipitate should be of a pure white color, and redissolve completely in an excess of the reagent.
	Alkalies, Magnesium, etc.	If from this solution in ammonium carbonate T.S. the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation.
	Sulphate.	The aqueous solution should not be rendered turbid by the addition of barium chloride T.S.

Uses.—Zinc chloride in solution is used as an antiseptic and disinfectant (see Liquor Zinci Chloridi, below). Externally, mixed with flour and water, it is used as an escharotic.

LIQUOR ZINCI CHLORIDI. *U. S.* Solution of Zinc Chloride.

An aqueous solution of Zinc Chloride [$ZnCl_2$ = 135.84], containing about 50 per cent., by weight, of the salt.

	Metric.	Old form.
Zinc, granulated	240 Gm.	6½ oz. av.
Hydrochloric Acid	840 Gm.	22 oz. av.
Nitric Acid	12 Gm.	100 minims.
Precipitated Zinc Carbonate	12 Gm.	186 grains.
Distilled Water, a sufficient quantity.		

To the Zinc, contained in a glass or porcelain vessel, add 150 C.c. [old form 4½ fl. oz.] of Distilled Water; then gradually add the Hydrochloric Acid, and digest, until the Acid is saturated. Pour off the solution, add the Nitric Acid, evaporate the solution to dryness, and heat the dry mass to fusion at a temperature not exceeding 115° C. (239° F.). Let it cool, and dissolve it in a sufficient amount of Distilled Water to make the product weigh 1000 Gm. [or measure, old form, 1 pint]. Then add the Precipitated Zinc Carbonate, agitate the mixture occasionally during twenty-four hours, and then set it aside until it has become clear by subsidence. Finally, separate the clear solution by decantation, or by means of a siphon.

When zinc is treated with hydrochloric acid, hydrogen is evolved and zinc chloride is produced.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Zinc Chloride.}}{2ZnCl_2} + \underset{\text{Hydrogen.}}{4H.}$$

Zinc is almost invariably contaminated with iron, and more or less ferrous chloride is present in the first solution. Nitric acid is added, and the solution is evaporated to dryness. The iron salt is thus oxidized, and it is then precipitated by the addition of zinc carbonate, the insoluble ferric hydrate and carbonate, with any excess of zinc carbonate, being filtered out.

Solution of chloride of zinc is a clear, colorless liquid, odorless, having a very astringent, sweetish taste, and an acid reaction. Sp. gr. 1.535. (See Zinci Chloridum, page 637, for the tests.)

Uses.—This solution, sometimes called *Burnett's disinfecting fluid*, is used principally as an antiseptic and disinfectant. Among its advantages, absence of odor is one of the most prominent.

ZINCI IODIDUM. *U.S.* Zinc Iodide.

ZnI_2; 318.16.

Preparation.—Zinc iodide may be formed by digesting an excess of zinc with iodine diffused in water, in a manner similar to that used in making the corresponding iron salt.

$$\underset{\text{Zinc.}}{Zn} + \underset{\text{Hydriodic Acid.}}{2HI} = \underset{\text{Zinc Iodide.}}{ZnI_2} + \underset{\text{Hydrogen.}}{2H.}$$

Zinci Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvent.
A white, granular powder, very deliquescent, and liable to absorb oxygen from the air, and to become brown from liberated iodine. When heated to about 446° C. (834.8° F.), the salt fuses to a colorless liquid, and at a higher temperature sublimes, forming quadratic needles, while a small part is decomposed and leaves a residue of zinc oxide.	Odorless; sharp, saline, and metallic taste; acid reaction.	Readily soluble.	Readily soluble.	Readily soluble in ether.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
A 5-per-cent. aqueous solution of the salt yields a pure, white precipitate with potassium ferrocyanide T.S., or with ammonium sulphide T.S. With silver nitrate T.S. it yields a pale yellow precipitate, insoluble in ammonia water; with mercuric chloride T.S. a scarlet-red precipitate, soluble in potassium iodide T.S. If 0.5 Gm. of dry Zinc Iodide be dissolved in 10 C.c. of water, and 2 drops of potassium chromate T.S. be added, not more than 31.4 C.c. nor less than 31 C.c. of decinormal silver nitrate V.S. should be required to produce a permanent red color (31.4 C.c. corresponding to 100 (99.9) per cent., and 31 C.c. to 98.62 per cent., of pure Zinc Iodide).	Arsenic, Cadmium, Lead, Copper, etc.	The aqueous solution, acidulated with hydrochloric acid, should not be colored or rendered turbid by hydrogen sulphide T. S.,
	Sulphate.	Nor by barium chloride T.S.
	Iron, Aluminum, Calcium, etc.	If ammonium carbonate T.S. be added to the aqueous solution, a pure white precipitate will form, which should redissolve completely in an excess of the reagent.
	Alkalies, Magnesium, etc.	If from the solution in ammonium carbonate T.S. all the zinc be precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation.

Uses.—Zinc iodide is used as an alterative, in doses of one-half grain to two grains (0.03 to 0.12 Gm.).

ZINCI OXIDUM. *U.S.* Zinc Oxide.

$ZnO = 81.06.$

Preparation.—Zinc oxide may be prepared by the former official process, as follows:

Take of Precipitated Carbonate of Zinc 12 oz. troy. Expose it, in a shallow vessel, to a low red heat until the water and carbonic acid are wholly expelled.

Commercial zinc oxide is made on the large scale by heating calamine and coal ground together, roasting in a furnace of peculiar construction, and separating the impurities by blowing the mixed vapors up a large tower, allowing the heavier particles to subside in the tower, and then by a powerful draught blowing the zinc oxide into a room containing muslin bags, when the oxide is deposited.

Zinci Oxidum. *U.S.*	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
An amorphous, white powder. It gradually absorbs carbon dioxide from the air. When heated, the Oxide assumes a yellow color, but turns nearly white again on cooling.	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in diluted acids without effervescence; also in ammonia water and in ammonium carbonate T.S.

Tests for Identity.	Impurities.	Tests for Impurities.
If a small portion be moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid green color.	Arsenic, Cadmium, Lead, Copper, etc.	In another portion of the filtrate, acidulated with hydrochloric acid, no color or turbidity should be produced by an equal volume of hydrogen sulphide T.S.
For making tests of identity and purity, digest 1 Gm. of Zinc Oxide during 1 hour, with occasional agitation, in a mixture of 10 C.c. of diluted sulphuric acid and 10 C.c. of water; then remove the undissolved Zinc Oxide by filtration.	Iron, Aluminum, Calcium, etc.	Another portion of the filtrate should yield with ammonium carbonate T.S. a pure white precipitate, which should redissolve completely in an excess of the reagent.
	Alkalies, Magnesium, etc.	If from this solution in ammonium carbonate T.S. the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should, on evaporation, leave no fixed residue.
	Chloride.	In another portion of the filtrate silver nitrate T.S. should not produce a turbidity.
	Alkaline Carbonate, etc.	If Zinc Oxide be agitated for some time with water, and a drop of phenolphtalein T.S. be added, no red color should appear.
In a portion of the filtrate a pure white precipitate is produced by potassium ferrocyanide T.S., or by ammonium sulphide T.S.	Carbonate.	If 10 C.c. of diluted sulphuric acid be added to 0.5 Gm. of Zinc Oxide, no effervescence should occur,
	Lead, Silicate, etc.	And a perfectly clear solution should result.
	Sulphate.	If Zinc Oxide be dissolved in diluted hydrochloric acid, the solution should remain perfectly clear after the addition of barium chloride T.S.

Commercial zinc oxide will not usually conform to the official tests: it is generally very white and filled with hard lumps, which are diffi-

cult to reduce to powder. The official powder has a decided cream tint, and can be mixed with ointment so that a smooth preparation is easily made without trituration. (See Unguentum Zinci Oxidi.)

Uses.—Zinc oxide is rarely used internally; externally, it is used as an exsiccant to inflamed surfaces, and it may be dusted on the part or used in the form of an ointment.

UNGUENTUM ZINCI OXIDI. *U.S.* Ointment of Zinc Oxide.

Made by incorporating 20 Gm. of zinc oxide with 80 Gm. of benzoinated lard.

OLEATUM ZINCI. *U.S.* Oleate of Zinc.

Made by dissolving 50 Gm. of zinc oxide in 950 Gm. of oleic acid by the aid of a gentle heat.

ZINCI PHOSPHIDUM. *U.S.* Zinc Phosphide.

$Zn_3P_2 = 257.22.$

Preparation.—Zinc phosphide is made by passing vapors of phosphorus in a current of dry hydrogen over fused zinc. The product is a spongy, gray mass, of metallic appearance, containing rhomboidal crystals, and when powdered somewhat resembling reduced iron. The metallic particles of zinc should be separated. It is a heavy powder, its sp. gr. being 4.72.

Zinci Phosphidum. *U.S.*	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
A gritty powder of a dark gray color, or crystalline fragments of a dark metallic lustre. In contact with air it slowly emits phosphorous vapor. When strongly heated, with exclusion of air, it melts, and finally sublimes. When heated in air, it becomes oxidized to zinc phosphate.	Faint odor and taste of phosphorus.	Insoluble.	Insoluble.	Soluble in diluted hydrochloric or sulphuric acid with evolution of hydrogen phosphide.

Impurities.	Tests for Impurities.
Insoluble Impurities.	If 0.5 Gm. of Zinc Phosphide be dissolved in 15 C.c. of diluted hydrochloric acid, heat being applied to expel all the hydrogen phosphide gas, a clear solution should result, leaving no residue.
Iron or Copper.	A portion of this solution should yield a pure white precipitate with potassium ferrocyanide T.S.,
Lead or Copper.	Or with ammonium sulphide T.S.
Arsenic, Cadmium, Lead, Copper, etc.	If another portion of this solution be mixed with an equal volume of hydrogen sulphide T.S., no color or turbidity should appear.

Uses.—Zinc phosphide is used as a nervous stimulant and aphrodisiac: it is frequently preferred to phosphorus for these purposes. The dose is one-twentieth to one-eighth of a grain (0.003 to 0.008 Gm.).

ZINCI SULPHAS. *U. S.* Zinc Sulphate.

$ZnSO_4 + 7H_2O = 286.64.$

Preparation.—Zinc sulphate is made by acting on metallic zinc with diluted sulphuric acid, hydrogen being evolved; the resulting solution is freed from the contamination of iron by first passing chlorine into it, when ferric chloride is produced, and, upon the addition of zinc carbonate, decomposition takes place, ferric hydrate separating as an insoluble precipitate, which is removed by filtration, and a small quantity of zinc chloride is formed, which, being very soluble, remains in the mother-liquor after the crystallization of the sulphate.

$$\underset{\text{Zinc.}}{2Zn} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Water.}}{H_2O} = \underset{\text{Zinc Sulphate.}}{2ZnSO_4} + \underset{\text{Hydrogen.}}{4H} + \underset{\text{Water.}}{H_2O}.$$

Zinci Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless, transparent, rhombic crystals, efflorescent in dry air. When rapidly heated the salt melts. At a higher temperature it is partly decomposed, losing both water and sulphuric acid. When very gradually heated to 50° C. (122° F.), it loses 5 molecules of its water (31.3 per cent.), without melting. At 100° C. (212° F.) a sixth molecule is lost, while the last may be removed by a current of dry air at 110° C. (230° F.).	Odorless; astringent, metallic taste; acid reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.2 part.	Insoluble.	Soluble in about 3 parts of glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
A 5-per-cent. aqueous solution yields a pure white precipitate with potassium ferrocyanide T.S., also with ammonium sulphide T.S., and with barium chloride T.S. If a small portion of the salt be moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid green color.	Lead and Other Insoluble Matters.	No residue should be left on dissolving 1 Gm. of the salt in 20 C.c. of water.
	Arsenic, Cadmium, Copper, etc.	The aqueous solution (1 in 20), after being acidulated with hydrochloric acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S.
	Iron, Aluminum, Calcium, etc.	The aqueous solution should yield with ammonium carbonate T.S. a pure white precipitate, which should redissolve completely in an excess of the reagent.
	Alkalies, Magnesium, etc.	If from this solution in ammonium carbonate T.S. the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation.
	Chloride.	The aqueous solution (1 in 20) should not be rendered turbid by silver nitrate T.S.
	Free Acid.	If 1 Gm. of Zinc Sulphate, in small fragments, be agitated for some time with 10 C.c. of alcohol, the filtrate should not redden moistened blue litmus paper.

Uses.—This salt is the most important of those made from zinc. It is used medicinally as a prompt and certain emetic in doses of ten

to thirty grains (0.6 to 1.9 Gm.); as a tonic and astringent, one to two grains (0.06 to 0.13 Gm.).

ZINCI VALERIANAS. *U. S.* Zinc Valerianate.

$$Zn(C_5H_9O_2)_2 + 2H_2O = 302.56.$$

Preparation.—The process for making this salt affords an illustration of the rather rare operation of "upward precipitation," the crystals of zinc valerianate being lighter than the mixed solutions:

Take of Sodium Valerianate 2½ oz. troy; Zinc Sulphate 2 oz. troy, 420 grains; Distilled Water a sufficient quantity. Dissolve the salts separately, each in 20 fluidounces of Distilled Water, and, having heated the solutions to 100° C. (212° F.), mix them, and set the mixture aside to crystallize. Decant the mother-water from the crystals, and put them upon a filter in a funnel to drain. Mix the mother-water and the drainings, evaporate at a heat not exceeding 93.3° C. (200° F.) to 4 fluidounces, and again set aside to crystallize. Add the crystals, thus obtained, to those in the funnel, wash the whole with a little Distilled Water, and, having removed them with the filter, spread them on bibulous paper, and dry them with a heat not exceeding 93.3° C. (200° F.).

$$\underset{\text{Sodium Valerianate.}}{2NaC_5H_9O_2} + \underset{\text{Zinc Sulphate.}}{ZnSO_4} = \underset{\text{Zinc Valerianate.}}{Zn(C_5H_9O_2)_2} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4}.$$

Zinci Valerianas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
White, pearly scales, permanent in the air. When heated, the salt melts; at a higher temperature it is decomposed, giving off inflammable vapors, and finally leaves a residue of zinc oxide.	Odor of valerianic acid; sweet, afterwards styptic and metallic taste; acid reaction.	At 15° C. (59° F.), 100 parts.	At 15° C. (59° F.), 40 parts.
		Boiling renders the solution turbid from loss of acid and formation of a basic salt.	

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If 0.5 Gm. of Zinc Valerianate be dissolved in a mixture of 0.5 C.c. of hydrochloric acid and 4.5 C.c. of water, the valerianic (isovalerianic) acid will be liberated, and float as an oily layer on the surface of the liquid.	Arsenic, Cadmium, Lead, Copper, etc.	After its removal, the clear solution should be neither colored nor rendered turbid by the addition of an equal volume of hydrogen sulphide T.S.
	Iron.	Zinc Valerianate should dissolve without residue in ammonia water.
	Alkalies, Magnesium, etc.	If from this solution the zinc be completely precipitated by ammonium sulphide T.S., the precipitate should have a pure white color, and the filtrate should leave no fixed residue on evaporation.
	Acetate.	If 0.5 Gm. of Zinc Valerianate be triturated with 2 C.c. of water and 0.2 C.c. of ferric chloride T.S. added, the filtrate should not show a red color.
	Butyrate.	If a concentrated solution of copper acetate in water be added to a concentrated aqueous solution of Zinc Valerianate, the mixture should remain perfectly clear.

Uses.—Zinc valerianate is used as a nervine and antispasmodic, in doses of one to three grains (0.06 to 0.19 Gm.).

Aluminum. Al; 27.04.

This metal is found largely in combination with silicic acid, in the rocks and clays forming a great portion of the earth's surface. Some of the precious stones and valuable minerals are compounds of aluminum; the ruby and sapphire, corundum and emery, are crystallized forms of aluminum oxide. Aluminum is of a silver-white color. The metal, owing to improvements in its extraction, is much cheaper than it was formerly, and it is used in making ornamental and useful articles. Owing to its very low specific gravity (2.67), it is used for grain weights, because they are much larger, and thus more easily handled, than they would be if made from brass (see page 68). Aluminum forms but one class of compounds, in which it is trivalent. The oxides and sulphates unite with those of the alkali metals and form double salts called *alums*.

Tests for Salts of Aluminum.

1. Potassium or sodium hydrate produces white, gelatinous precipitates of aluminum hydrate in solutions of alum, which are freely soluble in excess of the alkali.
2. Water of ammonia produces a similar precipitate, insoluble in excess.
3. The alkaline carbonates precipitate the hydrate, carbon dioxide being evolved.
4. Ammonium sulphide also precipitates the hydrate, sulphuretted hydrogen being evolved.

Official Preparations of Aluminum.

Official Name.	Preparation.
Alumen	By treating alum-clay with sulphuric acid and potassium sulphate.
Alumen Exsiccatum	By heating alum to a temperature of 205° C. (401° F.).
Alumini Hydras	By double decomposition of alum and sodium carbonate.
Alumini Sulphas	By treating aluminum hydrate with sulphuric acid and crystallizing.

Unofficial Preparations of Aluminum.

Alumini Acetas, $Al_26C_2H_3O_2$. Aluminum Acetate.	By dissolving aluminum hydrate in cold acetic acid, filtering and concentrating, then crystallizing.
Alumini Bromidum, Al_2Br_6. Aluminum Bromide.	By passing the vapor of bromine over a heated mixture of alumina and carbon.
Alumini Chloridum, Al_2Cl_6. Aluminum Chloride.	By dissolving aluminum hydrate in hydrochloric acid and evaporating carefully, then crystallizing.
Alumini Iodidum, Al_2I_6. Aluminum Iodide.	By heating aluminum and iodine together in closed tubes and collecting the crystals.
Alumini Nitras, $Al_2(NO_3)_6.18H_2O$. Aluminum Nitrate.	By dissolving aluminum hydrate in nitric acid, filtering and concentrating, then crystallizing.
Alumini Oxidum, Al_2O_3. Aluminum Oxide.	Occurs in nature.
Alumini Phosphas, $Al_2(PO_4)_2$. Aluminum Phosphate.	By adding a neutral solution of alumina to a solution of sodium phosphate, and collecting the gelatinous precipitate.

ALUMEN. *U. S.* Alum.

$$Al_2K_2(SO_4)_4 + 24H_2O = 946.46.$$

[POTASSIUM ALUM. ALUMINUM AND POTASSIUM SULPHATE.]

Preparation.—This valuable salt is made principally from alum-clay, which is chiefly aluminum silicate, by treating it with sulphuric acid, thereby forming aluminum sulphate. Potassium sulphate is then

added, when the double salt $K_2Al_2(SO_4)_4$ is produced. It crystallizes with twenty-four molecules of water. Ammonia-alum, $(NH_4)_2Al_2(SO_4)_4$, is generally found in the market, because of its greater cheapness.

Alumen. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Warm Glycerin.
Large, colorless, octohedral crystals, sometimes modified by cubes, or in crystalline fragments, which, on exposure to air, are liable to absorb ammonia and acquire a whitish coating. When gradually heated, the salt loses water; at 92° C. (197.6° F.) it melts, and if heat be gradually increased to 200° C. (392° F.), it loses 45.52 per cent. of its weight (all of its water of crystallization), leaving a bulky, white residue.	Odorless; sweetish and strongly astringent taste; acid reaction.	At 15° C. (59° F.), 9 parts. Boiling, 0.3 part.	Insoluble.	Freely soluble.

Tests for Identity.	Impurities.	Tests for Impurities.
With solution of potassa or of soda, Alum yields a white precipitate which is completely soluble in an excess of the alkali, no odor of ammonia being evolved (difference from, and absence of, *ammonia alum*). The aqueous solution also yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid. Ammonia water produces a bulky, white precipitate, which is nearly insoluble in an excess of ammonia.	Copper, Zinc, or Lead.	A 5-per-cent. aqueous solution of the salt should not be affected by hydrogen sulphide T.S.
When a saturated solution of the salt is actively shaken with tartaric acid, it affords, within half an hour, a white, crystalline precipitate.	Iron	20 C.c. of a 5-per-cent. solution should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S.

Uses.—Alum is a powerful astringent. When powdered, it is used as an emetic in croup, in doses of a teaspoonful. It is sometimes used as a local styptic, and is frequently employed in making astringent lotions and injections.

ALUMEN EXSICCATUM. *U. S.* Dried Alum.

$Al_2K_2(SO_4)_4 = 515.42.$

[Alumen Ustum. Burnt Alum.]

	Metric.	Old form.
Alum, in small pieces	100 Gm.	30 oz. av.
To make	55 Gm.	16 oz. av.

Place the Alum in a shallow porcelain capsule so as to form a thin layer, and heat it on a sand-bath until it liquefies. Then continue the application of a moderate heat, with constant stirring, until aqueous vapor ceases to be disengaged, and a dry, white, porous mass is obtained, weighing 55 Gm. [old form 16 oz. av.]. When cold, reduce the product to a fine powder, and preserve it in well-stoppered bottles.

This preparation represents alum nearly deprived of its water of crystallization: the latter exists in alum in the enormous proportion of nearly 45 per cent., thus constituting almost half of its weight.

Dried alum is officially described as a white, granular powder, attracting moisture when exposed to the air, odorless, having a sweetish, astringent taste, very slowly but completely soluble in 20 parts of water

at 15° C. (59° F.), and quickly soluble in 0.7 part of boiling water. It answers to the same reactions as Alum. (See Alumen.) Before pulverization, it is a light, white, opaque, porous mass.

Uses.—It is used as an escharotic. It is more powerful than alum, although not so soluble.

ALUMINI HYDRAS. *U. S.* Aluminum Hydrate.

$Al_2(OH)_6 = 155.84.$

[ALUMINUM HYDROXIDE. HYDRATED ALUMINA.]

	Metric.	Old form.
Alum	100 Gm.	16 oz. av.
Sodium Carbonate	100 Gm.	16 oz. av.
Distilled Water, a sufficient quantity.		

Dissolve each salt separately in 1000 C.c. [old form 10 pints] of Distilled Water, filter each solution, and heat it to boiling. Then, having poured the hot solution of Sodium Carbonate into a capacious vessel, gradually pour in the hot solution of Alum with constant stirring, and add an equal volume of boiling Distilled Water. Let the precipitate subside, decant the clear liquid, and pour upon the precipitate 2000 C.c. [old form 20 pints] of hot Distilled Water. Again decant, transfer the precipitate to a strainer, and wash it with hot Distilled Water, until the washings produce not more than a faint cloudiness with barium chloride T.S. Then allow it to drain, dry it at a temperature not exceeding 40° C. (104° F.), and reduce it to a uniformly fine powder.

$$\underset{\text{Potassium Alum.}}{K_2Al_2(SO_4)_4} + \underset{\text{Sodium Carbonate.}}{3Na_2CO_3} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Aluminum Hydrate.}}{Al_2(HO)_6} + \underset{\text{Potassium Sulphate.}}{K_2SO_4} + \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Carbon Dioxide.}}{3CO_2}$$

The direction to add the alum solution to that of the sodium carbonate is important. If the mixing of the solution is reversed, the precipitated hydrate will be contaminated with the alkaline sulphates, so that it will be much more difficult to separate them.

Alumini Hydras. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, light, amorphous powder, permanent in dry air. When heated to redness, it loses 34.6 per cent. of its weight (water of hydration).	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble without residue in hydrochloric or sulphuric acid; also in solution of potassium or sodium hydrate T.S.

Impurities.	Tests for Impurities.
Iron.	A solution of 1 Gm. of Aluminum Hydrate in 20 C.c. of diluted hydrochloric acid should not immediately be colored blue by a drop of potassium ferrocyanide T.S.
Sulphate.	A solution of 1 Gm. of Aluminum Hydrate in 20 C.c. of diluted hydrochloric acid should not give more than a faint cloudiness with barium chloride T.S.
Zinc or Lead.	When Aluminum Hydrate is dissolved in solution of potassa or of soda, it should yield no precipitate with hydrogen sulphide T.S.
Salts of Alkalies.	When Aluminum Hydrate is boiled with 20 parts of water, and filtered, the filtrate should leave not more than a slight residue on evaporation.

Uses.—Aluminum hydrate is a desiccant powder: it is absorbent and antacid. The dose is from two to five grains (0.13 to 0.32 Gm.). Externally, it is used like zinc oxide, by dusting on the inflamed surface.

ALUMINI SULPHAS. *U. S.* Aluminum Sulphate.

$Al_2(SO_4)_3 + 16H_2O$; 628.9.

Preparation.—This sulphate may be made by the process formerly official.

Take of Alum, Carbonate of Sodium, each, 4 oz. troy; Sulphuric Acid 1 oz. troy, 150 gr.; Water a sufficient quantity. Dissolve the salts separately, each in 6 fluidounces of boiling water, and pour the solution of the Alum gradually into that of the Carbonate of Sodium; then digest with a gentle heat until the evolution of carbonic acid ceases. Collect upon a filter the precipitate formed, and wash it with water, until the washings are no longer affected by chloride of barium. Next, with the aid of heat, dissolve the precipitate in the Sulphuric Acid, previously diluted with ½ pint of Water, and, having filtered the solution, evaporate it until a pellicle begins to form. Then remove it to a water-bath, and continue the evaporation, with constant stirring, until a dry salt remains. Lastly, preserve this in a well-stopped bottle.

Or the hydrate obtained by the process just noted (page 646) may be dissolved in diluted sulphuric acid, the solution evaporated, and the salt granulated.

Alumini Sulphas, *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A white, crystalline powder, permanent in the air. When gradually heated, the salt melts in its water of crystallization, and at or near 200° C. (392° F.) it loses the whole of it, amounting to 45.7 per cent. of its weight.	Odorless; sweetish and afterwards astringent taste; acid reaction.	Cold, 1.2 parts, with a trifling residue. Boiling, Very soluble.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid, and with potassium or sodium hydrate T.S. a white, gelatinous precipitate, which is soluble in excess of the alkali, but is again separated by the addition of a sufficient amount of ammonium chloride T.S.	Iron.	20 C.c. of a 5-per-cent. aqueous solution of the salt should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S.
	Copper, Lead, or Zinc.	A filtered 10-per-cent. aqueous solution of the salt should not be affected by hydrogen sulphide T.S.
	Free Acid.	A filtered 10-per-cent. aqueous solution of the salt should not become more than faintly opalescent within five minutes after the addition of an equal volume of decinormal sodium hyposulphite V.S.
	Ammonia.	If 1 Gm. of the salt be gently heated with 5 C.c. of potassium or sodium hydrate T.S., the liquid should not evolve the odor of ammonia.

Uses.—Aluminum sulphate is antiseptic: it is rarely used internally.

Cerium. Ce; 139.9.

Cerium is a metal occurring in *cerite*, *gadolinite*, etc.; it is of a chocolate-brown color, in masses; it takes fire more easily than magnesium; at ordinary temperatures it oxidizes in a moist atmosphere. Two oxides of cerium are known, Ce_2O_3, *cerous oxide*, and CeO_2, *ceric oxide*.

Test for Cerium Compounds.

If sodium hypochlorite be added to a solution of a colorless cerous salt, a red precipitate separates: this dissolves in warm hydrochloric acid, and evolves chlorine.

Official Preparation of Cerium.

Official Name.	Preparation.
Cerii Oxalas	By precipitating cerium chloride with oxalic acid.

Unofficial Preparations of Cerium.

Ceroso-cerii Oxidum, Ce_3O_4. Ceroso-ceric Oxide.	By igniting cerium oxalate in an open vessel and then collecting the mass.
Cerii Chloridum, $CeCl_3$. Cerium Chloride.	By burning cerium in chlorine gas and then collecting the mass.
Cerii Nitras, $CeNO_3.2H_2O$. Cerium Nitrate.	By dissolving ceroso-ceric oxide in nitric acid in presence of alcohol or some other reducing substance.
Cerii Oxidum, CeO. Cerium Oxide.	By heating cerium oxalate in a current of dry hydrogen perfectly free from air.
Cerii Sulphas, $Ce_2(SO_4)_3$. Cerium Sulphate.	By dissolving ceric oxide in sulphuric acid, and evaporating, then crystallizing.

CERII OXALAS. *U. S.* Cerium Oxalate.

$Ce_2(C_2O_4)_3 + 9H_2O = 704.78.$ [CEROUS OXALATE.]

Preparation.—This salt is made by decomposing the silicates in the powdered mineral containing the metal, with strong sulphuric acid, then heating the mass, and subsequently treating it with nitric and hydrosulphuric acids to separate contaminating metals. Hydrochloric acid is now added in small quantity, and the cerium compounds are precipitated by oxalic acid. This oxalate is impure, containing lanthanum and didymium compounds: it is therefore mixed with magnesium carbonate, and the mixture heated to redness to decompose the oxalates; the residue is dissolved in a small quantity of nitric acid, and the solution added to water containing a little sulphuric acid; ceric sulphate is produced, which is dissolved in sulphuric acid, and sodium hyposulphite added to reduce it to cerous sulphate; this is collected and treated with oxalic acid, when cerium oxalate precipitates. The complication in the method of preparation of this salt is due to the presence of the two rare metals didymium and lanthanum, which can be separated only with difficulty.

Cerii Oxalas. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, granular powder, permanent in the air. On heating the salt to a dull red heat, a yellowish-red residue of ceric oxide is left (a brown color would indicate the presence of didymium oxide).	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in diluted hydrochloric and sulphuric acid. Insoluble in ether, or in solutions of potassium or sodium hydrate.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
On boiling the salt with potassium or sodium hydrate T.S., white, cerous hydrate is left as insoluble residue. Supersaturating a portion of the cold filtrate with acetic acid, and adding calcium chloride T.S., a white precipitate is obtained, soluble in hydrochloric acid, but insoluble in acetic acid.	Aluminum.	A portion of the filtrate obtained by boiling the salt with potassium or sodium hydrate should not yield a precipitate on the addition of an excess of ammonium chloride T.S.
If the yellow residue left after heating be dissolved in concentrated sulphuric acid, and a small crystal of strychnine be added, a deep blue color will appear, which will rapidly change to purple and then to red. From the solution in diluted hydrochloric or sulphuric acid, potassium hydrate T.S. precipitates white, cerous hydrate, which does not redissolve in an excess of the reagent, and gradually turns yellow in contact with air. Ammonium carbonate T.S. precipitates white, cerous carbonate, which is somewhat soluble in excess of the reagent.	Zinc.	A portion of the filtrate obtained by boiling the salt with potassium or sodium hydrate should not yield a precipitate on the addition of ammonium sulphide T.S.
If 0.1 Gm. of Cerium Oxalate be dissolved in 1 C.c. of sulphuric acid, and 2 C.c. of potassium sulphate T.S. be added, small, colorless crystals of cerium potassium sulphate will be deposited after some time.	Carbonate, Arsenic, etc.	On dissolving the salt in hydrochloric acid, no effervescence should occur, and the solution should not be precipitated or rendered turbid by hydrogen sulphide.

Uses.—Cerium oxalate is a valuable remedy in controlling nausea. It is given in doses of two to ten grains (0.12 to 0.6 Gm.).

Cadmium. Cd; 111.5.

This metal is associated with zinc in its ores. Although it enters into *no official preparations*, it is used to some extent in medicine, and hence merits a notice here. It is a white metal, resembling tin, but somewhat heavier and more tenacious. Like that metal, it crackles when bent. Its sp. gr. is 8.7. It is little affected by the air, but when heated combines with an atom of oxygen, forming a reddish-brown or orange-colored oxide, CdO. It combines with chlorine, iodine, bromine, and sulphur.

Tests for Cadmium Salts.

1. Hydrogen sulphide and ammonium sulphide produce precipitates of a yellow color (sulphide) when added to solutions of cadmium salts.

2. Sodium or potassium hydrate produces, with cadmium salts, white precipitates (hydroxide), insoluble in excess. Ammonia water produces similar precipitates, soluble in excess.

3. Sodium or potassium carbonate produces white precipitates of cadmium carbonate, insoluble in excess.

Unofficial Compounds of Cadmium.

Cadmii Bromidum, $CdBr_2$. Cadmium Bromide.	By double decomposition between potassium bromide and cadmium sulphate.
Cadmii Chloridum, $CdCl_2$. Cadmium Chloride.	By treating cadmium or cadmium carbonate with hydrochloric acid.
Cadmii Iodidum, CdI_2. Cadmium Iodide.	By double decomposition between potassium iodide and cadmium sulphate.
Cadmii Oxidum, CdO. Cadmium Oxide.	By igniting cadmium nitrate or carbonate.
Cadmii Sulphidum, CdS. Cadmium Sulphide.	By passing hydrogen sulphide through a solution of cadmium chloride, nitrate, or sulphate.
Cadmii Sulphas, $CdSO_4.4H_2O$. Cadmium Sulphate.	By treating cadmium carbonate or oxide with diluted sulphuric acid.

QUESTIONS ON CHAPTER XLIII.

ZINC, ALUMINUM, CERIUM, AND CADMIUM.

Zinc—Give symbol and atomic weight.
In what form is zinc official?
How is it made?
What is its quantivalence?
What are the tests for zinc salts?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Arsenic; more than traces of lead, iron, and copper.
What are its uses?
Zinc acetate—Give formula in symbols and molecular weight.
Describe the process (formerly official) by which it may be prepared.
Describe rationale of the process.
Describe odor, taste, chemical reaction, and solubility.
Give tests for identity.
How may the following impurities be detected?—viz.: Lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
For what is it used?
Zinc bromide—Give formula in symbols and molecular weight.
How may zinc bromide be made (process of Lyons)?
In what other way may it be made?
Describe odor, taste, chemical reaction, and solubility.
Give tests for identity.
How may the following impurities be detected?—viz.: Lead or copper, iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
What is the dose?
Precipitated zinc carbonate—Give Latin name, formula in symbols, and molecular weight.
What is the British process for making this salt? Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility.
Give tests for identity.
How may the following impurities be detected?—viz.: Lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
For what is it used?
Zinc chloride—What is its formula in symbols? What is its molecular weight?
How is it prepared? Describe rationale of the process.
Describe odor, taste, chemical reaction, and solubility.
Give tests for identity.
How may the following impurities be detected?—viz.: Basic salt, lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
For what purposes is it used?
Solution of zinc chloride—What is the Latin official name? Give formula in symbols and molecular weight.
How much zinc chloride does it contain?
How is it prepared?
How may it be freed from iron which is usually present in the zinc from which it is prepared? Give description and specific gravity.
What is this solution sometimes called?
For what is it used?
Zinc iodide—Give Latin name, formula in symbols, and molecular weight.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
What is the dose?
Zinc oxide—Give Latin name, formula in symbols, and molecular weight.
What is the process (formerly official) by which it may be made?
How is it made on the large scale?
What is the difference between commercial zinc oxide and the official preparation?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Carbonate; lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkalies or of alkaline earths.
For what purposes is it used?
How is zinc oxide ointment made?
Zinc phosphide—Give formula in symbols and molecular weight.
How is it made? Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Lead or copper.
What is the dose?
Zinc sulphate—How is it prepared? Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Chloride; lead or copper; iron, aluminum, and most of the alkaline earths; salts of alkaline earths or of alkalies. What is the dose?
Zinc valerianate—How is this salt prepared? Give rationale of the process.
What is meant by upward precipitation?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Salts of alkalies and alkaline earths; butyrate. What is the dose?
Aluminum—Give symbol and atomic weight.
Where is this found? Give description and specific gravity.
What is its chemical quantivalence?
What are the salts known as alums?
What are the tests for salts of aluminum?
Alum—Give formula in symbols and molecular weight.
What was the official name of this salt in the U. S. P. 1870?
How is it generally made?
With how many molecules of water does it crystallize?
What kind of alum is generally found in the market?
What is its chemical composition?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc or lead; iron.
What is the dose?
Dried alum—Give its Latin official name.
How much water does alum contain?
Describe odor, taste, chemical reaction, and solubility.
For what is it used?
Aluminum hydrate—Give formula in symbols and molecular weight.
How is it prepared? Describe rationale of the process.
In what manner should the solutions be mixed, and why?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Iron; sulphate; zinc or lead; salts of alkalies. What is the dose?
Aluminum sulphate—Give formula in symbols and molecular weight.
Give the process (formerly official) by which it may be made.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Iron; more than 5 per cent. of sulphates of alkalies. What is it used for?
Cerium—Give symbol and atomic weight.
Where is it found, and what are its physical properties?
What oxides are known, and what is their composition?
What is the test for cerium compounds?
What official preparation is there of cerium?
Cerium oxalate—Give Latin name, formula in symbols, and molecular weight.
How is this salt made?
What two rare metals are usually found in combination with cerium?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Aluminum; zinc; carbonate; metallic impurities. What is the dose?
Cadmium—Give symbol, atomic weight, description, and specific gravity.
Describe odor, taste, and chemical reaction.
What combinations does it form?
What are the tests for cadmium salts?

CHAPTER XLIV.

MANGANESE, IRON, AND CHROMIUM.

Mn; 54.8. Fe; 55.88. Cr.; 52.0.

THESE three metals form a group exhibiting some chemical and physical analogies. They unite with oxygen, producing basic oxides.

Manganese. Mn; 54.

Manganese is found, as a mineral, quite extensively in the state of black oxide, as *pyrolusite*, *braunite*, and *hausmannite*. The carbonate also is sometimes found. The metal is very hard and brittle; when powdered, decomposing water readily. With oxygen it forms five—possibly seven—compounds. The *monoxide*, MnO, is of a light green color, and is the oxide present in or corresponding to manganous salts. The *sesquioxide*, Mn_2O_3, is black or dark brown, when in the hydrated state; the magnetic oxide, Mn_3O_4, is red; the dioxide, MnO_2, is black; and the permanganic oxide, Mn_2O_7, is, when in the free state, a very unstable dark reddish-brown liquid. The monoxide is a stable base, the sesquioxide feebly basic, and the dioxide when acted upon by acids yields manganous salts, while oxygen is evolved. The highest oxide is acid-forming, yielding permanganic acid, $HMnO_4$, the salts of which are known as permanganates. (See Potassii Permanganas, p. 508.) There exists also an acid, H_2MnO_4 (manganic), of which the salts formed are called manganates. The corresponding oxide, however, is not known.

Tests for Salts of Manganese.

1. Ammonium sulphide, added to a solution of a manganese salt, produces a flesh-colored precipitate of manganese sulphide.
2. Potassium or sodium carbonate in solution produces white precipitates, which are insoluble in excess of solution of ammonium carbonate.
3. With the blow-pipe, manganese gives with borax a bead having an amethystine color in the oxidizing flame, and a colorless bead in the deoxidizing flame.
4. If manganese be heated with sodium carbonate, *green* sodium manganate is produced. If this be added to water, it communicates a purplish-red color.

Official Preparations of Manganese.

Official Name.	Preparation.
Mangani Dioxidum	Manganese dioxide, containing at least 66 per cent. of pure oxide.
Mangani Sulphas	Made by treating manganese dioxide with sulphuric acid.
Potassii Permanganas	By heating manganese dioxide, potassium hydrate, and potassium chlorate together.

Unofficial Preparations of Manganese.

Mangani Arsenas, $MnHAsO_4$. Manganese Arsenate.	By saturating a solution of arsenic acid with freshly precipitated manganese carbonate.
Mangani Benzoas. Manganese Benzoate.	By adding to a solution of benzoic acid manganese carbonate as long as combination is effected.
Mangani Carbonas, $MnCO_3$. Manganese Carbonate.	By adding to a solution of manganese sulphate a solution of potassium carbonate, and collecting and drying the precipitate.
Mangani Chloridum, $MnCl_2$. Manganese Chloride.	By treating manganese dioxide with hydrochloric acid, purifying from iron salts, evaporating, and crystallizing.
Mangani Citras. Manganese Citrate.	By digesting manganese carbonate with citric acid, and collecting the precipitate.
Mangani Oxalas, $2MnC_2O_4.5H_2O$. Manganese Oxalate.	By adding to a solution of manganese sulphate a solution of oxalic acid, and collecting the precipitate.
Mangani Tartras. Manganese Tartrate.	By adding a solution of neutral potassium tartrate to a solution of manganous chloride, and, after the acid tartrate of potassium has deposited, collecting the colorless crystals.

MANGANI DIOXIDUM. *U. S.* Manganese Dioxide.

[MANGANI OXIDUM NIGRUM, PHARM. 1880. BLACK OXIDE OF MANGANESE.]

Native, crude Manganese Dioxide, containing at least 66 per cent. of the pure Dioxide [MnO_2; 86.72].

Black oxide of manganese is frequently found in commerce of poor and variable quality: some pyrolusite from Nova Scotia was examined by the author a few years ago, however, which assayed 96 per cent. of pure oxide. It is the safest rule to buy it only upon assay, and, when a good sample can be found, to secure a large quantity of it.

Mangani Dioxidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A heavy, grayish-black, more or less gritty powder, permanent in the air. It is not affected by cold, concentrated sulphuric acid, but when heated with the latter it is converted into manganous sulphate, with the evolution of oxygen.	Odorless; tasteless.	Insoluble.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated with hydrochloric acid, it is converted into manganous chloride, with the development of chlorine. At a red heat the Dioxide gives off oxygen gas, and is converted into reddish-brown manganoso-manganic oxide (Mn_3O_4). On intimately mixing 1 part of the Dioxide with 1 part of potassium hydrate and 1 part of potassium chlorate, introducing the mass into a crucible, moistening with water, drying, and igniting, a dark fused mass is obtained, which yields, with water, a green solution, changing to purplish-red on being boiled, or on the addition of diluted sulphuric acid.	Organic Impurities.	If a portion of the Dioxide be strongly heated in a dry test-tube, no combustion should ensue, nor should any carbon dioxide be evolved.
If 1 Gm. of the finely powdered Dioxide, contained in a small, long-necked flask, be mixed with 5 C.c. of water, then 4.22 Gm. of ferrous sulphate, in clear crystals, added, and subsequently 5 C.c. of hydrochloric acid, the mixture digested for about fifteen minutes at a gentle heat, and finally heated to boiling, the cooled filtrate, when immediately tested with freshly prepared potassium ferricyanide T.S., should not acquire a blue color (presence of at least 66 per cent. of pure *Manganese Dioxide*).	Metallic Sulphides.	If to another portion of the Dioxide, contained in a test-tube, a small quantity of diluted hydrochloric acid be added, no odor of hydrogen sulphide should be developed, nor should a strip of paper moistened with lead acetate T.S., and suspended over the mixture, become blackened.
	Antimony Sulphide.	After the mixture of the Dioxide with hydrochloric acid has been raised to boiling and filtered, the filtered liquid should not give, with hydrogen sulphide T.S., an orange-colored precipitate.

Uses.—Manganese dioxide is occasionally used internally, in doses of three to twenty grains (0.19 to 1.3 Gm.). Its principal use is to form the salts of manganese.

MANGANI SULPHAS. *U. S.* Manganese Sulphate.

$MnSO_4 + 4H_2O$; 222.46.

Preparation.—This salt is best made by Prof. Diehl's process, by heating manganese dioxide and charcoal together to redness, treating the residue with sulphuric acid, and again heating to redness; the residue is dissolved in water, the solution filtered and crystallized. (See U. S. Dispensatory, 17th ed., p. 849.)

Mangani Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, or pale rose colored, transparent, tetragonal prisms, crystallized at a temperature between 20° and 30° C. (68°–86° F.), and containing 4 molecules, or 32.29 per cent., of water of crystallization. Slightly efflorescent in dry air.	Odorless; slightly bitter and astringent taste; neutral or faintly acid reaction.	At 15° C. (59° F.), 0.8 part. Boiling, 1 part.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution yields, with ammonium sulphide T.S., a flesh-colored precipitate soluble in dilute acids; with potassium ferrocyanide T.S., a reddish-white precipitate; and with potassium ferricyanide T.S., a brown precipitate. With barium chloride T.S. it yields a white precipitate insoluble in hydrochloric acid.	Iron.	A 5-per-cent. aqueous solution of the salt, after being heated with a few drops of hydrochloric acid and a little chlorine water, should not be colored red by potassium sulphocyanate T.S.,
	Copper or Arsenic.	And should not be affected by hydrogen sulphide T.S.
If a fragment of the salt be mixed with a little sodium hydrate T.S., and the mixture then dried and fused, it will yield a dark green mass, dissolving in water with a green color.	Salts of the Alkalies or of Magnesium.	If the manganese be completely precipitated from an aqueous solution of the salt by ammonium carbonate T.S., the filtrate, on evaporation and gentle ignition, should leave no residue.
If 1 Gm. of the salt be gently ignited, in a porcelain crucible, it should lose not more than 0.323 Gm. of its weight (distinction from *Manganese Sulphate containing a larger amount of water of crystallization*).	Zinc.	A solution of 1 Gm., each, of the salt, and of sodium acetate, in 10 C.c. of water, to which a few drops of acetic acid are added, should not be affected by hydrogen sulphide T.S.

Uses.—Manganese sulphate is used as a tonic, in doses of five to twenty grains (0.3 to 1.3 Gm.).

POTASSII PERMANGANAS. *U. S.* Potassium Permanganate.

This is the most important official compound of manganese. It is considered under the potassium compounds (page 545).

Iron. Fe; 55.88.

Iron, the most useful and abundant of the metals, is widely diffused in nature: it is found not only in the mineral kingdom, but in animal and vegetable products as well.

Iron is a hard, malleable, ductile, and tenacious metal, of a grayish-white color and fibrous texture, a slightly styptic taste, and a sensible odor when rubbed. Its sp. gr. is 7.8. It is combustible, and, when heated to whiteness, burns in atmospheric air, and with brilliant scintillations in oxygen. At a red heat its surface is converted into black oxide, and at common temperatures, by the combined agency of air and moisture, it becomes covered with a reddish matter, called *rust*, which is hydrated ferric oxide. It combines with all the non-metallic elements except hydrogen and nitrogen, and with most of the metals. It forms three compounds with oxygen,—ferrous and ferric oxide, which, by their union, form the native magnetic oxide, and a teroxide possessing acid properties, called ferric acid.

Tests for Iron Salts.

1. Potassium *ferrocyanide* produces a nearly white precipitate with a ferrous salt, which rapidly turns blue on exposure to the air; with a ferric salt it strikes a deep blue color (Prussian blue) at once.
2. Potassium *ferricyanide* produces a deep blue color (Turnbull's blue) at once with a ferrous salt, and a greenish or olive color with a ferric salt.
3. Tannin does not change the color of a solution of ferrous salt, provided it has not been oxidized; with a ferric salt a dark greenish-black precipitate (ink) is produced.
4. Ammonium sulphide produces a black precipitate (sulphide) with either a ferrous or a ferric salt.
5. Ammonia water precipitates from ferrous salts, ferrous hydrate, a white precipitate turning green, then black, and finally a brown color; the same reagent precipitates brown ferric hydrate from ferric salts.

Official Preparations of Iron.

Official Name.	Preparation.
Ferrum	Metallic iron in the form of fine, bright, and non-elastic wire.
Ferrum Reductum	Made by passing hydrogen over iron subcarbonate.
Ferri Carbonas Saccharatus	Double decomposition between ferrous sulphate and sodium bicarbonate; the precipitate is preserved with sugar.
Massa Ferri Carbonatis	Double decomposition between ferrous sulphate and sodium carbonate; the precipitate is preserved with honey.
Mistura Ferri Composita	6 Gm. ferrous sulphate; 18 Gm. myrrh; 18 Gm. sugar; 8 Gm. potassium carbonate; 60 C.c. spirit of lavender; rose water sufficient to make 1000 C.c.
Pilulæ Ferri Carbonatis	16 Gm. ferrous sulphate; 8 Gm. potassium carbonate; 4 Gm. sugar; 1 Gm. powd. tragacanth; 1 Gm. powd. althæa; glycerin, water, to make 100 pills.
Ferri Chloridum	By acting on iron with hydrochloric acid and crystallizing the solution.
Liquor Ferri Chloridi	By oxidizing solution of ferrous chloride with nitric acid.
Tinctura Ferri Chloridi	250 C.c. of solution of ferric chloride with sufficient alcohol to make 1000 C.c.
Ferri Citras	By evaporating and scaling solution of ferric citrate.
Ferri et Ammonii Citras	By adding ammonia water to solution of ferric citrate, evaporating, and scaling.
Liquor Ferri Citratis	By dissolving ferric hydrate in citric acid.
Vinum Ferri Citratis	40 Gm. iron and ammonium citrate; 150 C.c. tincture of sweet orange peel; 100 C.c. syrup; sufficient white wine to make 1000 C.c.

Official Preparations of Iron.—*Continued.*

Official Name.	Preparation.
Ferri et Quininæ Citras	By dissolving quinine (alkaloid) in solution of ferric citrate, evaporating, and scaling.
Ferri et Quininæ Citras Solubilis	By adding ammonia water to solution of iron and quinine citrate, evaporating, and scaling.
Vinum Ferri Amarum	50 Gm. soluble iron and quinine citrate; 150 C.c. tincture of sweet orange peel; 300 C.c. syrup; sufficient white wine to make 1000 C.c.
Ferri et Strychninæ Citras	By adding to a solution of iron and ammonium citrate citric acid and strychnine, and scaling.
Syrupus Ferri, Quininæ et Strychninæ Phosphatum	By dissolving in an acid solution of ferric phosphate quinine, strychnine, and sugar.
Ferri et Ammonii Sulphas	By dissolving ammonium sulphate in solution of ferric tersulphate, evaporating, and crystallizing.
Ferri et Ammonii Tartras	By dissolving ferric hydrate in solution of acid ammonium tartrate, and scaling.
Ferri et Potassii Tartras	By adding to ferric hydrate acid potassium tartrate and a trace of ammonia water, and scaling.
Ferri Hypophosphis	Double decomposition between calcium hypophosphite and ferrous sulphate.
Ferri Iodidum Saccharatum	By adding solution of ferrous iodide to sugar of milk.
Syrupus Ferri Iodidi	By adding solution of ferrous iodide to sugar.
Pilulæ Ferri Iodidi	4 Gm. reduced iron, 5 Gm. iodine, 4 Gm. glycyrrhiza, 4 Gm. sugar, 1 Gm. ext. glycyrrhiza, 1 Gm. acacia, water q. s., in each pill.
Ferri Lactas	By acting on iron with lactic acid and crystallizing the solution.
Ferri Oxidum Hydratum	By adding ammonia water to solution of ferric tersulphate, and collecting and washing the precipitate.
Ferri Oxidum Hydratum cum Magnesia	By mixing solution of ferric tersulphate with magnesia mixture.
Trochisci Ferri	Each lozenge contains 5 gr. of dried ferric hydrate.
Emplastrum Ferri	90 Gm. ferric hydrate; 50 Gm. olive oil; 140 Gm. Burgundy pitch; 720 Gm. lead plaster.
Ferri Phosphas Solubilis	By mixing solutions of ferric citrate and sodium phosphate, evaporating, and scaling.
Ferri Pyrophosphas Solubilis	By mixing solutions of ferric citrate and sodium pyrophosphate, evaporating, and scaling.
Ferri Sulphas	By treating iron with diluted sulphuric acid, evaporating, and crystallizing.
Ferri Sulphas Exsiccatus	By exsiccating ferrous sulphate at a temperature not above 149° C. (300° F.).
Pilulæ Aloes et Ferri	7 Gm. purified aloes, 7 Gm. dried ferrous sulphate, 7 Gm. aromatic powder, confection of rose q. s., to make 100 pills.
Ferri Sulphas Granulatus	By precipitating an aqueous solution of ferrous sulphate with alcohol.
Ferri Valerianas	By double decomposition between ferric sulphate and sodium valerianate.
Liquor Ferri Acetatis	By dissolving ferric hydrate in glacial acetic acid.
Liquor Ferri et Ammonii Acetatis	20 C.c. tincture ferric chloride; 30 C.c. diluted acetic acid; 200 C.c. solution ammonium acetate; 100 C.c. aromatic elixir; 100 C.c. glycerin; sufficient water to make 1000 C.c.
Liquor Ferri Nitratis	By dissolving ferric hydrate in diluted nitric acid.
Liquor Ferri Subsulphatis	By heating ferrous sulphate in a mixture of sulphuric and nitric acids.
Liquor Ferri Tersulphatis	By heating ferrous sulphate in a mixture of nitric acid with excess of sulphuric acid.

Unofficial Salts of Iron.

Ferri Acetas, $Fe_2(C_2H_3O_2)_6$. Ferric Acetate.	By dissolving ferric hydrate in acetic acid, evaporating, then crystallizing.
Ferri Arsenas, $3Fe(FeO)AsO_4.16H_2O$. Ferric Arsenate.	By dissolving 1 oz. sodium arsenate and ¾ oz. sodium acetate in 8 oz. water, then dissolving 2 oz. ferrous sulphate in 10 fl. oz. water, mixing both solutions, collecting the precipitate, washing, and drying.
Ferri Benzoas, $Fe_26C_7H_5O_2.6H_2O$. Ferric Benzoate.	By adding to a solution of normal ferric sulphate a concentrated solution of sodium benzoate, collecting the precipitate, washing, and drying.
Ferri Bromidum, $FeBr_2$. Ferrous Bromide.	By adding 2 p. bromine to 1 p. iron filings and 10 p. water, digesting until the liquid assumes a greenish color, then filtering and evaporating to dryness.
Ferri et Sodii Pyrophosphas. Iron and Sodium Pyrophosphate.	By adding to a solution of 50 p. sodium pyrophosphate in 100 p. water sufficient ferric chloride in aqueous solution so that a permanent precipitate is not produced, then adding 250 p. alcohol and collecting the precipitate.
Ferri Ferrocyanidum, $Fe_4(FeCN_6)_3$. Iron Ferrocyanide.	By dissolving 4½ oz. potassium ferrocyanide in 1 pint water, adding the solution to 8 fl. oz. solution of normal ferric sulphate diluted previously with 8 fl. oz. water, stirring continually, collecting the precipitate, washing, and drying.
Ferri Nitras, $Fe_2(NO_3)_6$. Ferric Nitrate.	By concentrating a solution of ferric nitrate, filtering, and allowing to crystallize.
Ferri Oxalas. Ferrous Oxalate.	By mixing solutions of ferrous sulphate and oxalic acid and collecting the precipitate.
Ferri Oxidum Magneticum, Fe_3O_4. Magnetic Iron Oxide.	By dissolving 2 oz. ferrous sulphate in 2 pints water and adding 5½ fl. oz. solution of normal ferric sulphate, then mixing this with 4 pints solution of soda, stirring well, boiling, letting it stand for 2 hours, occasionally stirring, collecting the precipitate, washing, and drying carefully.
Ferri Oxidum Rubrum. Red Oxide of Iron.	By igniting ferrous sulphate in contact with air.
Ferri Phosphas Albus, $Fe_22PO_4.4H_2O$. Ferric Phosphate.	By mixing 4 fl. oz. solution of normal ferric sulphate with a solution of 1 oz. sodium acetate, then adding solution of sodium phosphate, collecting the precipitate, washing, and drying.
Ferri Salicylas. Ferric Salicylate.	By mixing a solution containing 24 grains of ferrous sulphate and 20 grains of sodium acetate in half a fluidounce of water with a solution made by dissolving 30 grains of sodium salicylate in half a fluidounce of water. Dose, a teaspoonful.
Ferri Subcarbonas. Ferric Oxyhydrate.	By mixing solutions of 8 oz. ferrous sulphate and 9 oz. sodium carbonate, collecting the precipitate, washing, and drying without heat.
Ferri Sulphidum, FeS. Ferrous Sulphide.	By mixing 3 p. iron filings with 2 p. sublimed sulphur, then placing in small portions the above mixture into a crucible heated to redness, and keeping covered after each addition.

FERRUM. *U S.* Iron.

Fe; 55.88.

Metallic Iron, in the form of fine, bright, non-elastic wire.

Iron, when employed in pharmaceutical operations, should be of the purest kind: hence the Pharmacopœias generally direct it, when wanted in small masses, to be in the form of *iron wire*, which is necessarily made from the purest, because the softest and most ductile, iron, and is readily cut into pieces. Such wire is very flexible and without elasticity.

The wire clippings and the ends of card-teeth obtained from the manufacturers of cotton-cards are frequently used in Philadelphia for making iron preparations. They are very convenient; and it may be incidentally mentioned that they are sometimes used as a substitute for sand, in sand-baths.

FERRUM REDUCTUM. *U.S.* Reduced Iron.

Preparation.—Reduced iron may be made by a process originally proposed by Prof. Procter, and afterwards made official in 1870:

Take of Subcarbonate of Iron 30 oz. troy. Wash the Subcarbonate thoroughly with water until no traces of sulphate of sodium are indicated by the appropriate tests, and calcine it in a shallow vessel until free from moisture. Then spread it upon a tray, made by bending an oblong piece of sheet-iron in the form of an incomplete cylinder, and introduce this into a wrought-iron reduction-tube, about four inches in diameter. Place the reduction-tube in a charcoal furnace, and, by means of a self-regulating generator of hydrogen, pass through it a stream of that gas, previously purified by bubbling successively through solution of subacetate of lead, diluted with three times its volume of water, and through milk of lime, severally contained in four-pint bottles about one-third filled. Connect with the further extremity of the reduction-tube a lead tube bent so as to dip into water. Make all the junctions air-tight by appropriate lutes; and, when the hydrogen has passed long enough to fill the whole of the apparatus to the exclusion of atmospheric air, light the fire, and bring that part of the reduction-tube, occupied by the Subcarbonate, to a dull-red heat, which must be kept up so long as the bubbles of hydrogen, breaking from the water covering the orifice of the lead tube, are accompanied by visible aqueous vapor. When the reduction is completed, remove the fire, and allow the whole to cool to the ordinary temperature, keeping up, during the refrigeration, a moderate current of hydrogen through the apparatus. Withdraw the product from the reduction-tube, and, should any portion of it be black instead of iron-gray, separate such portion for use in a subsequent operation. Lastly, having powdered the Reduced Iron, keep it in a well-stopped bottle. When thirty troyounces of Subcarbonate of Iron are operated on, the process occupies from five to eight hours.

The subcarbonate directed in the above formula is, more correctly, a ferric oxyhydrate, and the hydrogen combines with the oxygen to form water, metallic iron, in fine powder, being left.

$$\underset{\text{Ferric Oxide.}}{Fe_2O_3} + \underset{\text{Hydrogen.}}{6H} = \underset{\text{Iron.}}{2Fe} + \underset{\text{Water.}}{3H_2O.}$$

Ferrum Reductum. *U.S.*	Test for Impurities.
A very fine, grayish-black, lustreless powder, permanent in dry air, without odor or taste, and insoluble in water or alcohol. When ignited in contact with air it glows, and is converted into black ferroso-ferric oxide. When treated with diluted sulphuric acid, it causes the evolution of nearly odorless hydrogen gas, which should not affect paper moistened with lead acetate T.S. (absence of *sulphide*), and, on being warmed, it is nearly dissolved without leaving more than 1 per cent. of residue. Neutral reaction.	If 0.5 Gm. of Reduced Iron be added to 5 C.c. of arsenic-free hydrochloric acid, and the mixture be poured upon a filter while still effervescing, 1 C.c. of the clear filtrate should, after the addition of 2 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), together with a small piece of pure tin-foil, and gently heating, show no brown coloration within half an hour (limit of *arsenic*).

Estimation of the Metallic Iron.—Introduce 0.56 (0 559) Gm. of Reduced Iron into a glass-stoppered bottle, add 50 C.c. of mercuric chloride T.S, and heat the bottle, well stoppered, during one hour on a water-bath, frequently agitating. Then allow it to cool, dilute the contents with water to the volume of 100 C.c., and filter. To 10 C.c. of the filtrate, contained in a glass-stoppered bottle (having a capacity of about 100 C.c.), add 10 C.c. of diluted sulphuric acid, and subsequently decinormal potassium permanganate V.S., until a permanent red color is produced. The number of C c. of the volumetric solution required, when multiplied by *ten*, will indicate the percentage of metallic iron.

To confirm the assay, decolorize the liquid by a few drops of alcohol, then add 1 Gm. of potassium iodide, and digest for half an hour at a temperature of 40° C. (104° F.). The cooled solution, mixed with a few drops of starch T.S., should require not less than 8 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color (each C.c. of the volumetric solution indicating 10 per cent. of metallic iron).

Uses.—Powder of iron, or reduced iron, is one of the best of the chalybeate tonics. It is generally given in pill form, in doses of three to six grains (0.19 to 0.38 Gm.). An elegant form of administering it is combined with chocolate in the form of lozenges.

FERRI CARBONAS SACCHARATUS. *U. S.* **Saccharated Ferrous Carbonate.**

	Metric.	Old form.
Ferrous Sulphate	50 Gm.	5 oz. av.
Sodium Bicarbonate	35 Gm.	3½ oz. av.
Sugar, in fine powder,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	10 oz. av.

Dissolve the Ferrous Sulphate in 200 C.c. [old form 20 fl. oz.] of hot Distilled Water, and the Sodium Bicarbonate in 500 C.c. [old form 50 fl. oz.] of Distilled Water at a temperature not exceeding 50° C. (122° F.), and filter the solutions separately. To the solution of Sodium Bicarbonate contained in a flask having a capacity of about 1000 C.c. [old form 6 pints] add, gradually, the solution of Ferrous Sulphate, and mix thoroughly by rotating the flask. Fill up the flask with boiling Distilled Water, cork it loosely, and set the mixture aside. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, and then fill the flask again with hot Distilled Water, and shake it. Again draw off the clear liquid, and repeat the washing with hot Distilled Water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Finally drain the precipitate thoroughly on a muslin strainer, transfer it to a porcelain capsule containing 80 Gm. [old form 8 oz. av.] of Sugar, and mix intimately. Evaporate the mixture to dryness, by means of a water-bath, reduce it to powder, and mix intimately with it, if necessary, enough well-dried Sugar to make the final product weigh 100 Gm. [old form 10 oz. av.].

Keep the product in small, well-stoppered bottles.

In this preparation ferrous carbonate is formed, sodium sulphate remaining in solution. Sodium bicarbonate is preferred because the evolution of carbonic acid during the decomposition measurably prevents oxidation: it would have been an improvement to use syrup in the solutions to protect them still further.

The object of boiling the water that is used in washing is to expel the air, so that the ferrous carbonate may escape its oxidizing action; the evaporation of the mixture should be conducted as rapidly as possible, for the same reason.

$$\underset{\text{Ferrous Sulphate.}}{FeSO_4} + \underset{\text{Sodium Bicarbonate.}}{2NaHCO_3} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Ferrous Carbonate.}}{FeCO_3} + \underset{\text{Water.}}{H_2O} + \underset{\text{Carbon Dioxide.}}{CO_2}$$

Ferri Carbonas Saccharatus. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Other Solvents.
A greenish-brown powder, gradually oxidized by contact with air, but completely soluble, with copious evolution of carbonic acid gas, in diluted hydrochloric acid, forming a clear, yellow liquid.	Odorless; at first a sweetish, afterwards a slightly ferruginous taste; neutral reaction.	Partially soluble.	Completely soluble, with copious evolution of carbonic acid gas, in diluted hydrochloric acid, forming a clear, yellow liquid.

Quantitative Test.	Impurities.	Test for Impurities.
If 1.16 (1.1573) Gm. of Saccharated Ferrous Carbonate be dissolved in 10 C.c. of diluted sulphuric acid, and the solution diluted with water to about 100 C.c., it should require about 15 C.c. of decinormal potassium permanganate V.S. to impart a permanent pink tint to the liquid, corresponding to about 15 per cent. of ferrous carbonate (each C.c. of the volumetric solution indicating 1 per cent. of pure Ferrous Carbonate).	Sulphate.	If 1 Gm. of Saccharated Ferrous Carbonate be dissolved in 5 C.c. of hydrochloric acid, and the solution diluted with water to the measure of 50 C.c., portions of this solution will afford a blue precipitate with both potassium ferrocyanide T.S. and potassium ferricyanide T.S., but should not be affected by barium chloride T.S.

Uses.—Saccharated ferrous carbonate is used as a tonic, in doses of five to thirty grains (0.3 to 1.9 Gm.).

MASSA FERRI CARBONATIS. *U. S.* Mass of Ferrous Carbonate.

[Vallet's Mass.]

	Metric.	Old form.
Ferrous Sulphate, in clear crytals	100 Gm.	8 oz. av.
Sodium Carbonate	100 Gm.	8 oz. av.
Clarified Honey	38 Gm.	3 oz. av.
Sugar, in coarse powder	25 Gm.	2 oz. av.
Syrup,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	8 oz. av.

Dissolve the Ferrous Sulphate and the Sodium Carbonate, each separately, in 200 C.c. [old form 1 pint] of boiling Distilled Water, and, having added 20 C.c. [old form 1½ fl. oz.] of Syrup to the solution of the Iron salt, filter both solutions, and allow them to become cold. Introduce the solution of Sodium Carbonate into a bottle having a capacity of about 500 C.c. [old form 3 pints], and gradually add the solution of the Iron salt, rotating the flask constantly or fre-

quently, until carbonic acid gas no longer escapes. Add a sufficient quantity of Distilled Water to fill the bottle; then cork the bottle and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and, having mixed Syrup and Distilled Water in the proportion of one volume of Syrup to nineteen volumes of Distilled Water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste. Drain the precipitate on a muslin strainer, and express as much of the Water as possible. Lastly, mix the precipitate at once with the Honey and Sugar, and, by means of a water-bath, evaporate the mixture in a tared capsule, with constant stirring, until it is reduced to 10 Gm. [old form 8 oz. av.].

This preparation consists of ferrous carbonate preserved from oxidation by contact with syrup and honey. The reaction is as follows:

$$\underset{\text{Ferrous Sulphate.}}{FeSO_4} + \underset{\text{Sodium Carbonate.}}{Na_2CO_3} = \underset{\text{Ferrous Carbonate.}}{FeCO_3} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4}.$$

Uses.—Mass of ferrous carbonate is widely known as *Vallet's mass:* it is a valuable chalybeate tonic, and is administered in pill form, in doses of five to fifteen grains (0.3 to 0.9 Gm.).

MISTURA FERRI COMPOSITA. *U. S.* **Compound Iron Mixture.**

This mixture depends for its usefulness upon the ferrous carbonate produced by double decomposition between ferrous sulphate and potassium carbonate. The myrrh, sugar, spirit of lavender, and rose water are used as adjuvants and diluents (see p. 317).

PILULÆ FERRI CARBONATIS. *U. S.* **Pills of Ferrous Carbonate.**

Each pill contains 2½ gr. of ferrous sulphate, 1½ gr. of potassium carbonate, ¾ gr. of sugar, with sufficient tragacanth, althæa, glycerin, and water to form a mass. When the pill reaches the fluids in the stomach, ferrous carbonate is produced through the reaction between the ferrous sulphate and the sodium carbonate.

FERRI CHLORIDUM. *U. S.* **Ferric Chloride.**

$Fe_2Cl_6 + 12H_2O = 539.5.$

	Metric.	Old form.
Iron, in the form of fine, bright wire, and cut into small pieces	15 Gm.	2 oz. av.
Hydrochloric Acid,		
Nitric Acid,		
Distilled Water, each, a sufficient quantity.		

Introduce the Iron wire into a flask having a capacity of about 200 C.c. [old form 2 pints], pour upon it 54 Gm. [old form 6 fl. oz.] Hydrochloric Acid, previously diluted with 25 C.c. [old form 3 fl. oz.] of Distilled Water, and let the mixture stand in a moderately warm place until effervescence ceases; then heat it to the boiling point, filter it through paper, and, having rinsed the flask and Iron wire with a little hot Distilled Water, pass the rinsings through the filter. To the filtered liquid add 28 Gm. [old form 3⅛ fl. oz.] of Hydrochloric Acid, add the mixture, slowly and gradually, in a stream, to 8 Gm. [old form 6 fl. dr.] of Nitric Acid, contained in a capacious porcelain

vessel, and warm gently. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor. Then test a few drops of the liquid, diluted with water, with freshly prepared potassium ferricyanide test-solution. Should this reagent produce a blue color, add a little more Nitric Acid, drop by drop, as long as effervescence is observed, and evaporate off the excess. Then add 5 Gm. [old form 4 fl. dr.] of Hydrochloric Acid, and enough Distilled Water to make the whole weigh 60 Gm. [old form 8 oz. av.], and set this aside, covered with glass, until it forms a solid crystalline mass. Lastly, break the salt into pieces, and keep it in a glass-stoppered bottle, protected from light.

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Hydrochloric Acid.}}{4HCl} = \underset{\text{Ferrous Chloride.}}{(FeCl_2)_2} + \underset{\text{Hydrogen.}}{4H.}$$

Ferrous chloride is converted into ferric chloride by the addition of nitric and hydrochloric acids; thus,—

$$\underset{\text{Ferrous Chloride.}}{6FeCl_2} + \underset{\text{Hydrochloric Acid.}}{6HCl} + \underset{\text{Nitric Acid.}}{2HNO_3} = \underset{\text{Ferric Chloride.}}{3Fe_2Cl_6} + \underset{\text{Nitrogen Dioxide.}}{N_2O_2} + \underset{\text{Water.}}{4H_2O.}$$

Ferri Chloridum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Orange-yellow, crystalline pieces, very deliquescent in moist air. At 35.5° C. (96° F.) the salt melts, forming a reddish-brown liquid. When strongly heated, it decomposes with the loss of water and hydrochloric acid, while the anhydrous salt sublimes, leaving a residue of ferric oxide.	Odorless, or having a faint odor of hydrochloric acid; strongly styptic taste; acid reaction.	Freely and wholly soluble.	Freely and wholly soluble.	Freely and wholly soluble in 1 part of ether and 3 parts of alcohol.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The dilute, aqueous solution yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in nitric acid, with silver nitrate T.S.	Zinc and Copper.	If the iron be completely precipitated from a solution of the salt by an excess of ammonia water, the filtrate should be colorless, and should not yield either a white or a dark-colored precipitate with hydrogen sulphide T.S.
If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 10 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture kept for half an hour at a temperature of 40° C. (104° F.), and then allowed to cool, it should, after the addition of a few drops of starch T.S., require 20 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).	Salts of Fixed Alkalies.	A solution of the salt should not leave a fixed residue on evaporation and gentle ignition.
	Nitric Acid.	On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute solution of the salt, the crystal should not become colored brown, nor should there be a brownish-black color developed around it.
	Ferrous Salt.	A few drops of a solution of the salt, added to freshly prepared potassium ferricyanide, should impart to the latter a pure brown color without a tinge of blue.
	Oxychloride.	A 1-per-cent. solution of the salt, in distilled water, when boiled in a test-tube, should remain clear.

Uses.—Ferric chloride is used externally as a styptic, and internally as a chalybeate tonic, in doses of three to five grains (0.19 to 0.32 Gm.).

LIQUOR FERRI CHLORIDI. *U. S.* Solution of Ferric Chloride.

An aqueous solution of Ferric Chloride [Fe_2Cl_6 = 323.98], containing about 37.8 per cent. of the anhydrous salt, corresponding to 62.9 per cent. of the crystallized salt [$Fe_2Cl_6 + 12H_2O$ = 539.5], or to about 13 per cent. of metallic iron.

	Metric.	Old form.
Iron, in the form of fine, bright wire, and cut into small pieces	150 Gm.	3½ oz. av.
Hydrochloric Acid	870 Gm.	17 fl. oz.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	1000 Gm.	1 pint.

Introduce the Iron Wire into a flask having a capacity of about 2000 C.c. [old form 3 pints], pour upon it a mixture of 540 Gm. [old form 10½ fl. oz.] of Hydrochloric Acid and 250 C.c. [old form 5½ fl. oz.] of Distilled Water, and let the mixture stand in a moderately warm place until effervescence ceases; then heat it to the boiling point, filter it through paper, and, having rinsed the flask and Iron Wire with a little hot Distilled Water, pass the rinsings through the filter. To the filtered liquid add 280 Gm. [old form 5½ fl. oz.] of Hydrochloric Acid, add the mixture slowly and gradually, in a stream, to 80 Gm. [old form 1 fl. oz. 3 fl. dr.] of Nitric Acid contained in a capacious porcelain vessel, and warm gently. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor. Then test a few drops of the liquid, diluted with water, with freshly prepared potassium ferricyanide test-solution. Should this reagent produce a blue color, add a little more Nitric Acid, drop by drop, as long as effervescence is observed, and evaporate off the excess. Finally, add the remaining 50 Gm. [old form 1 fl. oz.] of Hydrochloric Acid and enough Distilled Water to make the solution weigh 1000 Gm. [old form 1 pint].

The reaction which takes place here is exactly the same as that in ferric chloride, which has been described on page 662; the processes being identical with one exception, that the solution is crystallized to make the salt. If this solution, when finished, has a blackish color, it is due to incomplete oxidation, and the remedy is to heat it to boiling in a capacious dish, adding a few drops of nitric acid until the color changes to a clear ruby-red and effervescence ceases. If a brown precipitate is deposited upon dilution or standing, deficiency of hydrochloric acid is indicated, and the solution must be heated, and a few drops of the acid added until the precipitate is dissolved.

Liquor Ferri Chloridi. *U. S.*	Odor, Taste, and Reaction.
A reddish-brown liquid. Specific gravity about 1.387 at 15° C. (59° F.).	Faint odor of hydrochloric acid; acid, strongly styptic taste; acid reaction.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The diluted Solution affords a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in nitric acid, with silver nitrate T.S.	Zinc, Copper.	If the iron be completely precipitated from a portion of the Solution by excess of ammonia water, the filtrate should be colorless, and should not yield either a white or a dark-colored precipitate with hydrogen sulphide T.S.
If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 26 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).	Salts of the Fixed Alkalies.	The Solution, after the iron has been completely precipitated from it by an excess of ammonia water, should leave no fixed residue on evaporation and gentle ignition.
	Nitric Acid.	On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute portion of the Solution, the crystal should not become colored brown, nor should there be a brownish-black color developed around it.
	Ferrous Salt.	A few drops added to freshly prepared potassium ferricyanide T.S. should impart to it a pure brown color without a trace of green or greenish-blue.
	Oxychloride.	On diluting 1 C.c. of the Solution, with water, to 40 C.c., and boiling, the liquid should remain clear.

Uses.—This solution is occasionally used as a hæmostatic: its principal use, however, is to form, by dilution with alcohol, the well-known tincture of ferric chloride.

TINCTURA FERRI CHLORIDI. *U. S.* Tincture of Ferric Chloride.

This tincture is made by diluting 250 C.c. of solution of ferric chloride with 750 C.c. of alcohol, the mixture to stand in a closely-covered vessel at least three months: it is then to be transferred to glass-stoppered bottles (see page 367). The object of allowing the mixture to stand three months before it is to be used is to permit the formation of ethyl chloride and other similar ethereal compounds, the result of the action of the free acid on the alcohol. These ethers are supposed to give to the tincture diuretic properties. If a brownish-red precipitate of ferric oxychloride takes place upon diluting the solution of ferric chloride, it shows that the solution has not been made properly and is deficient in free hydrochloric acid (see above).

Uses.—Tincture of ferric chloride is undoubtedly the most important liquid iron preparation that is used: it is an efficient chalybeate, tonic, and styptic. The dose is from ten to thirty minims (0.6 to 1.8 C.c.), diluted with water: it should be sucked through a glass tube, to prevent injury to the teeth.

FERRI CITRAS. *U. S.* Ferric Citrate.

Solution of Ferric Citrate, a convenient quantity.

Evaporate the Solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in well-stoppered bottles, protected from light.

Ferri Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent, garnet-red scales, permanent in the air.	Odorless; very faint ferruginous taste; acid reaction.	Cold, Slowly but completely soluble. Boiling, Readily soluble, but diminishing in solubility by age.	Insoluble.

Tests for Identity, etc.	Impurities.	Tests for Impurities.
The aqueous solution of the salt is not precipitated, but is rendered darker, by ammonia water. If heated with potassium or sodium hydrate T.S., it affords a brown-red precipitate, without evolving any vapor of ammonia. On adding potassium ferrocyanide T.S. to an aqueous solution of the salt, a bluish-green color or precipitate is produced, which is increased and rendered dark blue by the subsequent addition of hydrochloric acid (difference from iron and ammonium citrate). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, with the aid of a gentle heat, and, after the addition of 1 Gm. of potassium iodide, the mixture kept for half an hour at a temperature of 40° C. (104° F.) and then allowed to cool, and mixed with a few drops of starch T.S., it should require about 16 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).	Citrates or Tartrates of the Fixed Alkalies.	When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper.
		If a 10-per-cent. solution of the salt be deprived of its iron by boiling with an excess of potassium or sodium hydrate T.S., and the filtrate be slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually afford a white, crystalline precipitate.
	Tartrate.	Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not afford a white, crystalline precipitate.

Uses.—This salt is *very slowly* soluble in water, and hence is not largely used in making solutions. It is very useful in making pills, its slow solubility being an advantage in preventing the flattening and cohering which usually take place when the more soluble form is used. The dose is five to twenty grains (0.3 to 1.3 Gm.).

FERRI ET AMMONII CITRAS. *U. S.* **Iron and Ammonium Citrate.**

	Metric.	Old form.
Solution of Ferric Citrate	100 C.c.	10 fl. oz.
Ammonia Water	40 C.c.	4 fl. oz.

Mix the Solution of Ferric Citrate with the Ammonia Water, evaporate the mixture by means of a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in well-stoppered bottles, protected from light.

Prof. J. U. Lloyd modifies this process with advantage by using, instead of ammonia water, a definite quantity of ammonium citrate in solution (see U. S. Dispensatory, 17th ed., page 607).

Ferri et Ammonii Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent, garnet-red scales, deliquescent on exposure to damp air.	Odorless; saline, mildly ferruginous taste; neutral reaction.	Readily and wholly soluble.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution of the salt is not precipitated, but is rendered darker, by ammonia water. With potassium ferrocyanide T.S. the solution does not give a blue color or precipitate, unless it be acidulated with hydrochloric acid (difference from *ferric citrate*). If heated with potassium or sodium hydrate T.S., it affords a brownish-red precipitate, and vapor of ammonia is evolved. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.) and then allowed to cool, and mixed with a few drops of starch T.S., it should require about 16 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).	Citrates or Tartrates of the Fixed Alkalies.	When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper.
		If a 10-per-cent. solution of the salt be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually afford a white, crystalline precipitate.
	Tartrate.	Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not afford a white, crystalline precipitate.

Uses.—Ammonio-ferric citrate is a useful modification of ferric citrate, the object of adding the ammonia water being to make the salt more soluble. The dose is five to twenty grains (0.3 to 1.3 Gm.).

LIQUOR FERRI CITRATIS. *U. S.* Solution of Ferric Citrate.

An aqueous solution of Ferric Citrate, corresponding to about 7.5 per cent. of metallic iron.

	Metric.	Old form.
Solution of Ferric Sulphate	1050 Gm.	10½ oz. av.
Citric Acid	300 Gm.	3 oz. av.
Ammonia Water	880 C.c.	8¾ fl. oz.
Water, a sufficient quantity,		
To make	1000 Gm.	10 oz. av.

Mix the Ammonia Water with 3000 C.c. [old form 30 fl. oz.] of cold Water, and the Solution of Ferric Sulphate with 10000 C.c. [old form 6 pints] of cold Water. Add the latter solution slowly to the diluted Ammonia Water, with constant stirring. Pour the mixture on a wet muslin strainer, and allow the liquid to run off and the precipitate to drain. Then remove the moist mass from the strainer, mix it well with 6000 C.c. [old form 3½ pints] of cold Water, again pour it on the strainer, and let it drain. Repeat this washing with several successive portions of cold Water in the same manner, until the

washings cease to produce more than a slight cloudiness with barium chloride test-solution. Then allow the precipitate to drain completely, transfer it to a porcelain capsule, add the Citric Acid, and heat the mixture, on a water-bath, to 60° C. (140° F.), stirring constantly, until the precipitate is dissolved. Lastly, filter the liquid, and evaporate it, at the above-mentioned temperature, until it weighs 1000 Gm. [old form 10 oz. av.].

In this preparation ferric hydrate is precipitated, ammonium sulphate being washed out, and the former is then dissolved in citric acid and the solution brought to a definite strength.

$$\underset{\text{Ferric Sulphate.}}{Fe_23SO_4} + \underset{\text{Ammonium Hydrate.}}{6NH_4HO} = \underset{\text{Ferric Hydrate.}}{Fe_2(HO)_6} + \underset{\text{Ammonium Sulphate.}}{3(NH_4)_2SO_4}.$$

Liquor Ferri Citratis. *U.S.*	Odor, Taste, and Reaction.
A dark brown liquid. Sp. gr. about 1.250 at 15° C. (59° F.). Upon evaporating 100 Gm. of the Solution, in a thin layer, on plates of glass, about 42.5 to 43 Gm. of garnet-red scales will be obtained.	Odorless; slightly ferruginous taste; acid reaction.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The Solution is not precipitated, but only rendered darker, by ammonia water. With potassium ferrocyanide T.S., it affords a bluish-green color or precipitate, which is increased and rendered dark blue by the subsequent addition of hydrochloric acid. On heating the Solution with potassium or sodium hydrate T.S., it will yield a brown precipitate, without evolving vapor of *ammonia*. If to another portion of the acidulated and cooled filtrate a little calcium chloride T.S. be added, and the liquid heated to boiling, it should gradually deposit a white crystalline precipitate. If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 15 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).	Tartrate.	If a portion of the Solution, diluted with 4 volumes of water, be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of this liquid, when allowed to stand for some time, should not give a white crystalline precipitate.

Uses.—This solution deserves to be known better and used oftener than it has been in the past. It keeps well, and much labor will be saved by the pharmacist if he will use it in all cases where an aqueous solution of ferric citrate is needed. It is of just *half* the strength of the scaled salt, and therefore the use of a double quantity of this solution will be found very convenient.

VINUM FERRI CITRATIS. *U. S.* Wine of Ferric Citrate.

This preparation, known more frequently as *Wine of Iron*, is made by dissolving 40 Gm. of iron and ammonium citrate in a mixture of 100 C.c. of syrup, 150 C.c. of tincture of sweet orange-peel, and sufficient white wine to make 1000 C.c. It is used as an agreeable chalybeate tonic, in doses of a fluidrachm (3.7 C.c.) (see page 383).

FERRI ET QUININÆ CITRAS. *U. S.* Iron and Quinine Citrate.

	Metric.	Old form.
Ferric Citrate	85 Gm.	13 oz. av. 262 gr.
Quinine, dried at 100° C. (212° F.) to a constant weight	12 Gm.	1 oz. av. 400 gr.
Citric Acid	3 Gm.	210 grains.
Distilled Water, a sufficient quantity,		
To make	100 Gm.	16 oz. av.

Dissolve the Ferric Citrate in 160 C.c. [old form 26 fl. oz.] of Distilled Water by heating on a water-bath at a temperature not exceeding 60° C. (140° F.). To this solution add the Quinine and Citric Acid, previously triturated with 20 C.c. [old form 3½ fl. oz.] of Distilled Water, and stir constantly until the Quinine and Citric Acid are dissolved. Lastly, evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light.

This well-known salt is simply a ferric citrate containing quinine in the proper quantity to make a good medicinal preparation. No chemical formula is officially given to it, for the sufficient reason that it is not regarded as a definite chemical compound. It is often found deficient in quinine, and sometimes with a cheaper alkaloid substituted for it.

It frequently occurs in the market in light-green scales. This color is due to the use of ammonia or ammonium citrate with the view of making the salt more soluble.

The official salt is not intended to be very soluble, the bitter taste being much less perceptible than when ammonia is combined with the citric acid.

Care should be exercised in buying this salt from the manufacturer to specify the U. S. P. salt, as two kinds are sometimes kept for sale.

Ferri et Quininæ Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Transparent, thin scales, of a reddish-brown color to yellowish-brown, slowly deliquescent in damp air. Slowly but wholly soluble in cold water, more readily soluble in hot water, and but slightly soluble in alcohol. Its solubility is diminished by age.	Odorless; bitter and mildly ferruginous taste; acid reaction.	Cold, Slowly but wholly soluble. Boiling, More readily.	Slightly soluble.

Tests for Identity.	Quantitative Test.
On the addition of a solution of the salt with a slight excess of ammonia water, the color of the liquid is deepened, and a white, curdy precipitate is thrown down. A small portion of the filtrate, when mixed with potassium ferrocyanide T.S., does not produce a blue color or precipitate unless it is acidulated with hydrochloric acid. Another portion of the filtrate, treated with an excess of potassium or sodium hydrate T.S., deposits a brownish-red precipitate. If a 10-per-cent. solution of the salt be deprived of its iron and quinine by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, gradually deposits a white crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not afford a white crystalline precipitate (absence of *tartrate*). When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of *citrates or tartrates of the fixed alkalies*).	*Estimation of the Quinine.*—Dissolve 1.12 (1.1176) Gm. of Iron and Quinine Citrate in a capsule, with the aid of a gentle heat, in 20 C.c. of water. Transfer the solution, together with the rinsings of the capsule, to a separator, allow the liquid to become cold, then add 5 C.c. of ammonia water and 10 C.c. of chloroform, and shake. Allow the liquids to separate, draw off the chloroform layer, and shake the residuary liquid a second and a third time with 10 C.c. of chloroform. Allow the combined chloroformic extracts to evaporate spontaneously in a tared capsule, and dry the residue at a temperature of 100° C. (212° F.) to a constant weight. This residue should weigh not less than 0.1288 Gm. (corresponding to at least 11.5 per cent. of dried quinine), and should respond to the reactions and tests of quinine (see *Quinina*). *Estimation of the Iron.*—Heat the aqueous liquid, from which the quinine has been removed in the manner just described, on a water-bath, until the odor of chloroform and ammonia has disappeared, allow it to cool, and dilute it with water to the volume of 50 C.c. Transfer 25 C.c. of the liquid to a glass-stoppered bottle (having the capacity of about 100 C.c.), add 2 C.c. of hydrochloric acid and 1 Gm. of potassium iodide, and allow the mixture to stand for half an hour at a temperature of 40° C. (104° F.). After it has been allowed to cool, and been mixed with a few drops of starch T.S., it should require about 14.5 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).

Uses.—This is a valuable tonic combination, and is particularly useful in making pills, because of its slow solubility (see Ferri Citras). To supply the demand for a more popular salt, the soluble iron and quinine citrate was made official. The dose of the salt is from five to ten grains (0.3 to 0.6 Gm.).

FERRI ET QUININÆ CITRAS SOLUBILIS. *U. S.* **Soluble Iron and Quinine Citrate.**

	Metric.	Old form.
Ferric Citrate	85 Gm.	13 oz. av. 262 gr.
Quinine, dried at 100° C. (212° F.) to a constant weight	12 Gm.	1 oz. av. 400 gr.
Citric Acid	3 Gm.	210 grains.
Ammonia Water,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	16 oz. av.

Dissolve the Ferric Citrate in 160 C.c. [old form 26 fl. oz.] of Distilled Water, by heating on a water-bath at a temperature not exceeding

60° C. (140° F.). To this solution add the Quinine and Citric Acid previously triturated with 20 C.c. [old form 3½ fl. oz.] of Distilled Water, and stir constantly until the Quinine and Citric Acid are dissolved. Then add gradually, and with constant stirring, 50 C.c. [old form 8 fl. oz.], or a sufficient quantity, of Ammonia Water, so that, after the addition of each portion of the latter, the precipitated Quinine will be redissolved and the liquid acquire a greenish-yellow tint. Lastly, evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in well-stoppered bottles, protected from light.

Ferri et Quininæ Citras Solubilis. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent scales, of a greenish, golden-yellow color, deliquescent in damp air. On the addition of a slight excess of ammonia water the color of the liquid is deepened, and a white, curdy precipitate is produced. If a portion of the filtrate from this precipitate be mixed with some potassium ferrocyanide T.S., it does not afford a blue color or precipitate, unless it be acidulated with hydrochloric acid. Another portion of the filtrate, treated with an excess of potassium or sodium hydrate T.S., gives a brownish-red precipitate.	Odorless; bitter, mildly ferruginous taste; slightly acid reaction.	Cold, Rapidly and completely.	Cold, Partially.

Tests for Identity.	Impurities.	Tests for Impurities.
If a portion of the salt be heated with potassium or sodium hydrate T.S., vapor of ammonia is evolved. If a 10-per-cent. solution of the salt be deprived of its iron and quinine by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually deposit a white, crystalline precipitate. Soluble Iron and Quinine Citrate, when assayed for Quinine and Iron by the method described under *Ferri et Quininæ Citras*, should respond to the requirements for the latter.	Citrates or Tartrates of the Fixed Alkalies.	When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper.
	Tartrate.	Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not give a white, crystalline precipitate. (See test for identity.)

Uses.—This is the soluble form of iron and quinine citrate, and is preferred by pharmacists when solutions are needed quickly. It differs from the salt considered on page 668 only in containing ammonia.

VINUM FERRI AMARUM. *U. S.* Bitter Wine of Iron.

This wine is made by dissolving 50 Gm. of soluble iron and quinine citrate in 500 C.c. of white wine, and adding 150 C.c. of tincture of sweet orange-peel, 300 C.c. of syrup, and sufficient white wine to make 1000 C.c. (see page 383). It is used as a mild ferruginous tonic, in doses of two to four teaspoonfuls (7.3 to 14.7 C.c.).

FERRI ET STRYCHNINÆ CITRAS. *U. S.* **Iron and Strychnine Citrate.**

	Metric.	Old form.
Iron and Ammonium Citrate	98 Gm.	490 gr.
Strychnine	1 Gm.	5 grains.
Citric Acid	1 Gm.	5 grains.
Distilled Water	120 C.c.	11 fl. dr.
To make	100 Gm.	1 oz. av.

Dissolve the Iron and Ammonium Citrate in 100 C.c. [old form 9 fl. dr.] of Distilled Water, and the Strychnine, together with the Citric Acid, in 20 C.c. [old form 2 fl. dr.] of Distilled Water. Mix the two solutions, evaporate the mixture by means of a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light. This salt contains 1 per cent. of strychnine.

Ferri et Strychninæ Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent scales, varying in color from garnet-red to yellowish-brown, deliquescent in damp air.	Odorless; bitter and slightly ferruginous taste; slightly acid reaction.	Readily and wholly soluble.	Slightly soluble.

Tests for Identity and Quantitative Test.

On heating the aqueous solution of the salt with potassium or sodium hydrate T.S., a brownish-red precipitate is produced, and vapor of ammonia is evolved. On adding potassium ferrocyanide T.S. to a dilute aqueous solution of the salt, no blue color or precipitate is produced unless the solution is acidulated with hydrochloric acid. If a ten-per cent. solution of the salt be deprived of its iron and strychnine by boiling with an excess of potassium or sodium hydrate T.S., the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually deposit a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not deposit a white, crystalline precipitate (*absence of tartrate*). When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper.

Estimation of the Strychnine.—Dissolve 2.24 (2.2352) Gm. of Iron and Strychnine Citrate, in a separator, in 15 C.c. of water, add 5 C.c. of ammonia water and 10 C.c. of chloroform, and shake. Allow the liquids to separate, draw off the chloroform layer, and shake the residuary liquid a second and a third time with 10 C.c. of chloroform. Allow the combined chloroformic extracts to evaporate spontaneously in a tared capsule, and dry the residue at a temperature of 100° C. (212° F.) to a constant weight. This residue should weigh not less than 0.02 Gm. nor more than 0.0224 Gm. (corresponding to not less than 0.9 nor more than 1 per cent. of strychnine), and should respond to the reactions and tests of strychnine (see *Strychnina*).

Estimation of the Iron.—Heat the aqueous liquid, from which the strychnine has been removed in the manner just described, on a water-bath, until the odor of chloroform and ammonia has disappeared, allow it to cool, and dilute it with water to the volume of 100 C.c. Transfer 25 C.c. of the liquid to a glass-stoppered bottle (having the capacity of about 100 C.c.), add 2 C.c. of hydrochloric acid and 1 Gm. of potassium iodide, and allow the mixture to stand for half an hour, at a temperature of 40° C. (104° F.). After it has been allowed to cool, and been mixed with a few drops of starch T.S., it should require about 16 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).

Uses.—This salt is used as a bitter ferruginous tonic, in doses of three to five grains (0.19 to 0.32 Gm.).

SYRUPUS FERRI, QUININÆ ET STRYCHNINÆ PHOSPHATUM.

U. S. **Syrup of Iron, Quinine, and Strychnine Phosphates.**

This syrup is made by dissolving 20 Gm. of ferric phosphate, 30 Gm. of quinine sulphate, and 0.2 Gm. of strychnine in 48 C.c. of phosphoric acid, 100 C.c. of glycerin, 50 C.c. of water, and sufficient syrup to make 1000 C.c. (see page 305). It is sometimes known as *Easton's Syrup*. On keeping, it gradually deposits an insoluble precipitate containing a portion of the alkaloids. The dose is one to two teaspoonfuls (3.7 to 7.4 C.c.).

FERRI ET AMMONII SULPHAS. *U. S.* Ferric Ammonium Sulphate.

$$Fe_2(NH_4)_2(SO_4)_4 + 24H_2O = 962.1.$$

[AMMONIO-FERRIC SULPHATE. AMMONIO-FERRIC ALUM.]

Ferric Ammonium Sulphate should be kept in well-stoppered bottles.

Preparation.—Ammonio-ferric alum may be made by the process formerly official:

Take of Solution of Tersulphate of Iron 2 pints, Sulphate of Ammonium 4½ oz. troy. Heat the Solution of Tersulphate of Iron to the boiling point, add the Sulphate of Ammonium, stirring until it is dissolved, and set the liquid aside to crystallize. Wash the crystals quickly with very cold water, wrap them in bibulous paper, and dry them in the open air.

$$\underset{\text{Ferric Sulphate.}}{Fe_23SO_4} + \underset{\text{Ammonium Sulphate.}}{(NH_4)_2SO_4} = \underset{\text{Ammonio-ferric Sulphate.}}{Fe_2(NH_4)_2(SO_4)_4}.$$

It is well to choose the cold winter weather to prepare this salt, if it is possible to make a choice, as handsome crystals may then be obtained with little labor. This compound is not very stable, melting oftentimes in hot summer weather in its water of crystallization.

Ferri et Ammonii Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Pale violet, octohedral crystals, efflorescent on exposure to air. When strongly heated, the crystals fuse, lose their water of crystallization, swell up, and finally leave a pale brown residue.	Odorless; acid, styptic taste; slightly acid reaction.	At 15° C. (59° F.), 3 parts. Boiling, 0.8 part.	Insoluble.

Tests.	Impurities.	Test for Impurities.
The aqueous solution of the salt yields a blue precipitate with potassium ferrocyanide T.S. With potassium or sodium hydrate T.S., it affords a brownish-red precipitate, and if the mixture be heated, vapor of ammonia is evolved. With barium chloride T.S., it produces a white precipitate insoluble in hydrochloric acid. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), and then allowed to cool, and mixed with a few drops of starch T.S., it should require not less than 11.6 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).	Aluminum.	If all the iron be precipitated from a solution of the salt by treating with an excess of potassium or sodium hydrate T.S., the resulting filtrate, when neutralized with hydrochloric acid, and then mixed with ammonia water, should not yield a white, gelatinous precipitate.

Uses.—Iron alum is used as a styptic in saturated solution. It partakes more of the characteristics of an alum than of an iron salt.

FERRI ET AMMONII TARTRAS. *U. S.* **Iron and Ammonium Tartrate.**

[AMMONIO-FERRIC TARTRATE.]

	Metric.	Old form.
Solution of Ferric Sulphate	100 C.c.	8 fl. oz. 3 fl. dr.
Tartaric Acid	29 Gm.	1 oz. av.
Distilled Water	200 C.c.	7 fl. oz.
Ammonia Water,		
Water, each, a sufficient quantity.		

To 110 C.c. [old form 3 fl. oz. 6 fl. dr.] of Ammonia Water, previously diluted with 250 C.c. [old form 8 fl. oz.] of cold Water, add, with constant stirring, the Solution of Ferric Sulphate, previously diluted with 1300 C.c. [old form 42 fl. oz.] of cold Water. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, then mix the precipitate intimately with about 1500 C.c. [old form 48 fl. oz.] of cold Water, again draw off the clear liquid, and repeat the washing with Water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Then transfer the precipitate to a wet muslin strainer, allow it to drain, and express the water as completely as possible. Dissolve one-half of the Tartaric Acid in the Distilled Water, neutralize the solution exactly with Ammonia Water, then add the other half of the Tartaric Acid, and dissolve it by the application of a gentle heat. Now add the moist ferric hydrate, in successive portions, stirring constantly, and continue the heat, which should not exceed 60° C. (140° F.), until the hydrate is dissolved. Filter the solution while hot, evaporate it in a porcelain vessel, at or below the above-mentioned temperature, to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light.

Theoretically, this salt is supposed to have the following composition: $2(FeO)NH_4,C_4H_4O_6.3H_2O$. The formula indicates a double tartrate, in which the two basylous hydrogen atoms have been substituted by one of iron and one of ammonium radical. The scaled salts are, however, not definite compounds.

The object in this process is to form a compound in which ferric hydrate is made soluble by acid ammonium tartrate, and the double salt iron and ammonium tartrate is produced.

Ferri et Ammonii Tartras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent scales, varying in color from garnet-red to reddish-brown, only slightly deliquescent.	Odorless; sweetish and slightly ferruginous taste; neutral reaction.	Very soluble.	Insoluble.

Tests for Identity.	Impurities.	Test for Impurities.
The aqueous solution of the salt is not precipitated, but is rendered darker, by ammonia water. If heated with potassium or sodium hydrate T.S., it yields a brownish-red precipitate, and vapor of ammonia is evolved. On adding potassium ferrocyanide to an aqueous solution of the salt, no blue color or precipitate is produced unless the solution is acidulated with hydrochloric acid. If a solution of the salt be deprived of iron by boiling with an excess of solution of soda, the concentrated and cooled filtrate, when supersaturated with acetic acid, will afford a white, crystalline precipitate. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 17 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).	Citrates or Tartrates of the Fixed Alkalies.	When strongly heated, the salt chars, emits fumes having the odor of burnt sugar, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper.

Uses.—This preparation is a mild chalybeate, the dose being ten to thirty grains (0.6 to 1.9 Gm.).

FERRI ET POTASSII TARTRAS. *U. S.* Iron and Potassium Tartrate.

[Potassio-Ferric Tartrate.]

	Metric.	Old form.
Solution of Ferric Sulphate	100 C.c.	8 fl. oz. 8 fl. dr.
Potassium Bitartrate	38 Gm.	1 oz. av. 150 gr.
Distilled Water	300 C.c.	10 fl. oz.
Ammonia Water,		
Water, each, a sufficient quantity.		

To 110 C.c. [old form 3 fl. oz. 6 fl. dr.] of Ammonia Water, previously diluted with 250 C.c. [old form 8 fl. oz.] of cold Water, add, under constant stirring, the Solution of Ferric Sulphate, previously diluted with 1300 C.c. [old form 44 fl. oz.] of cold Water. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, then mix the precipitate intimately with about 1500 C.c. [old form 50 fl. oz.] of cold Water, again draw off the clear liquid, and repeat the washing with Water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Then transfer the precipitate to a wet muslin strainer, allow it to drain, and express the water as completely as possible. Mix the Potassium Bitartrate with the Distilled Water in a porcelain vessel, heat the mixture, on a water-bath, to a temperature not exceeding 60° C. (140° F.), and gradually add the moist ferric hydrate, stirring constantly until it is dissolved. Filter the liquid while hot, and let the filtrate stand in a cool, dark place for twenty-four hours. Then stir it well with a porcelain or glass spatula, so that the precipitate which has formed in it may be thoroughly incorporated

with the liquid. Now add, very cautiously, just enough Ammonia Water to dissolve the precipitate, evaporate the solution in a porcelain vessel, at or below the above-mentioned temperature, to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in well-stoppered bottles, protected from light.

The intention in making iron and potassium tartrate is to replace the hydrogen in the acid potassium tartrate with iron, so that a double salt is produced like potassium and sodium tartrate.

Ferri et Potassii Tartras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, transparent, slightly deliquescent scales, varying in color from garnet-red to reddish-brown. When strongly heated, the salt chars, emits fumes having the odor of burnt sugar, and finally leaves a dark brown residue, having a strongly alkaline reaction, and effervescing with acids (distinction from *iron and ammonium tartrate*).	Odorless; sweetish, slightly ferruginous taste; neutral reaction.	Very soluble.	Insoluble.

Tests for Identity.

The aqueous solution of the salt is not precipitated, but is rendered darker, by ammonia water. If heated with potassium or sodium hydrate T.S., it yields a brownish-red precipitate, and a slight odor of ammonia is evolved. On adding potassium ferrocyanide T.S. to an aqueous solution of the salt, no blue color or precipitate is produced, unless the solution is acidulated with hydrochloric acid. If a 10-per-cent. solution of the salt be deprived of its iron by boiling with an excess of potassium or sodium hydrate T.S., the filtrate when slightly acidulated with acetic acid will gradually deposit a white, crystalline precipitate.

If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.) and then allowed to cool and mixed with a few drops of starch T.S., it should require about 15 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron.)

Uses.—This is a mild ferruginous tonic, and is given in doses of ten to thirty grains (0.6 to 1.9 Gm.).

The French use this salt by making it into an olive-shaped ball, to which a loop of string is attached; a lead-pencil or any convenient stick is run through the loop, and the ball suspended over a glass containing wine or water, at such a height as to dip into the liquid, so as to dissolve the necessary quantity: the liquid is soon impregnated with the iron salt, and a second dose is prepared like the first by refilling the glass. This form is called "*Boule de Mars*," and furnishes a ready method of obtaining a mild chalybeate draught.

FERRI HYPOPHOSPHIS. *U. S.* Ferric Hypophosphite.

$Fe_2(PH_2O_2)_6$; 501.04.

Preparation.—This is among the hypophosphites brought into notice in consequence of their recommendation by Dr. Churchill in the treatment of phthisis, in which they were thought to be useful by the intro-

duction of phosphorus into the system. This particular salt may be considered preferable to others when a marked condition of anæmia indicates a deficiency of iron in the tissues. It may be made by the action of hypophosphorous acid on ferrous carbonate formed by precipitation from ferrous sulphate; but, as some difficulty has been found in obtaining this acid perfectly pure, preference has been given to the plan of double decomposition. This salt may be made by causing ferrous sulphate and calcium hypophosphite to react on each other in molecular proportions represented by 480 grains of crystallized ferrous sulphate and 326 grains of commercial hypophosphite,—in the latter an allowance of 10 per cent. being made for impurities ordinarily found in that salt. These quantities will yield 320 grains of ferric hypophosphite, and the reaction will be represented by the following formula:

$$\begin{array}{ccccccc} Ca(H_2PO_2)_2 & + & FeSO_4 & = & CaSO_4 & + & Fe(H_2PO_2)_2. \\ \text{Calcium} & & \text{Ferrous} & & \text{Calcium} & & \text{Ferrous} \\ \text{Hypophosphite.} & & \text{Sulphate.} & & \text{Sulphate.} & & \text{Hyposulphite.} \end{array}$$

Calcium sulphate is precipitated, and ferrous hypophosphite is held in solution. In this condition the salt is a ferrous compound; but on evaporation the ferrous salt becomes ferric, and acquires the properties detailed in the Pharmacopœia.

Ferri Hypophosphis. *U. S.*	Odor and Taste.	Solubility.	
		Water.	Other Solvents.
A white or grayish-white powder, permanent in the air.	Odorless; nearly tasteless.	Slightly soluble; more readily soluble in presence of hypophosphorous acid.	Freely soluble in warm, concentrated solutions of the citrates of the alkalies, with which it forms green solutions.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When strongly heated in a dry test-tube, the salt evolves a spontaneously inflammable gas (hydrogen phosphide), and, on complete ignition, leaves a residue of ferric pyrophosphate. The salt is readily oxidized by nitric acid or other oxidising agents.	Phosphate.	If 0.5 Gm. of the salt be boiled with 10 C.c of potassium or sodium hydrate T.S., a reddish-brown precipitate will be produced; and if to the filtrate from the latter, slightly acidulated with hydrochloric acid, magnesia mixture be added, and subsequently an excess of ammonia water, no crystalline precipitate should be produced.
If 0.1 Gm. of Ferric Hypophosphite be mixed with 10 C.c. of water, then 10 C.c. of diluted sulphuric acid and 50 C.c. of decinormal potassium permanganate V.S. added, and the mixture boiled for fifteen minutes, it should require not more than 3 C.c. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 98.1 per cent. of the pure salt).	Carbonate.	If to 0.5 Gm. of the salt 5 C.c. of acetic acid be added, no effervescence should occur.
	Calcium.	And if the mixture be subsequently heated to boiling, the filtrate, upon cooling, should afford no turbidity with ammonium oxalate T.S.

Uses.—Ferric hypophosphite is given in anæmia and in cases of defective nerve-nutrition: it is administered in the form of pills, powders, or syrup. The dose is from five to ten grains (0.3 to 0.6 Gm.).

FERRI IODIDUM SACCHARATUM. *U. S.* **Saccharated Ferrous Iodide.**

	Metric.	Old form.
Iron, in the form of fine, bright wire, and cut into small pieces	6 Gm.	30 grains.
Reduced Iron	1 Gm.	5 grains.
Iodine	17 Gm.	85 grains.
Distilled Water,		
Sugar of Milk, recently dried, each, a sufficient quantity,		
To make	100 Gm.	500 grains.

Mix the Iron Wire, Iodine, and 20 C.c. [old form 3 fl. dr.] of Distilled Water in a flask of thin glass, shake the mixture occasionally, until the reaction ceases, and the solution has acquired a green color and lost the smell of Iodine; then filter it through a small, wetted filter into a porcelain capsule containing 40 Gm. [old form 200 gr.] of Sugar of Milk. Rinse the flask and Iron Wire with a little Distilled Water, pass the rinsings through the filter into the capsule, and evaporate, on a water-bath, with frequent stirring, until a dry mass remains. Transfer this quickly to a heated iron mortar, reduce it to powder, and mix it intimately, by trituration, with the Reduced Iron and enough Sugar of Milk to make the final product weigh 100 Gm. [old form 500 grains]. Transfer the powder at once to small and perfectly dry bottles, which should be securely stoppered, and kept in a cool and dark place.

This process requires first the production of ferrous iodide (see Syrupus Ferri Iodidi, page 304); the solution is then evaporated quickly and granulated, diluted with sugar of milk, powdered, and at once introduced into bottles. This powder, upon keeping, is very apt to become oxidized and show the presence of free iodine. The object of adding reduced iron to the finished product is that it may combine with any iodine set free. When of a brown color it should not be dispensed.

Ferri Iodidum Saccharatum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A yellowish-white or grayish, very hygroscopic powder.	Odorless; sweetish, ferruginous taste; slightly acid reaction.	At 15° C. (59° F.), 7 parts, with the exception of the added reduced iron, and forming an almost clear solution.	Partially soluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution yields a blue precipitate with potassium ferricyanide T.S. If mixed with a little starch T.S., and afterwards with a little chlorine water, the solution assumes a deep blue color. If 1.55 (1.5447) Gm. of Saccharated Ferrous Iodide be dissolved in about 20 C.c. of water, in a small flask, and to this solution be successively added, first, 22 C.c. of decinormal silver nitrate V.S., then 5 C.c. of diluted nitric acid and 5 C.c. of ferric ammonium sulphate T.S., it should not require more than 2 C.c. of decinormal potassium sulphocyanate V.S. to produce a reddish-brown tint, which persists after shaking (corresponding to about 20 per cent. of pure Ferrous Iodide).	Salts of Fixed Alkalies.	When strongly heated, the compound swells up, evolves the odor of iodine and of burnt sugar, and, on complete ignition, leaves a residue, which should yield nothing soluble to water.
	Free Iodine.	The color produced by adding to the salt some starch T.S., and afterwards a little chlorine water, should not be developed in the aqueous solution by starch T.S. alone.

SYRUPUS FERRI IODIDI. *U. S.* Syrup of Ferrous Iodide.

A syrupy liquid containing 10 per cent. of Ferrous Iodide [FeI; 309.1].

This syrup is prepared by forming a solution of ferrous iodide by acting on iron wire with iodine in the presence of water; the green solution of ferrous iodide is then protected by the addition of syrup, and the mixture is filled into small, well-stoppered bottles which are accessible to daylight. The object of exposing the syrup to daylight is to prevent the separation of free iodine, to which the irritant action is due, the syrup being prone to decomposition and discoloration from this separation: when iodine is diffused through water and is exposed to light, colorless hydriodic acid is formed, and this is measurably protected from change through the intervention of the syrup. (See Syrupus Acidi Hydriodici, page 300.) The dose of this syrup is from ten to thirty minims (0.6 to 1.8 C.c.): it should be largely diluted, and sucked through a glass tube, to protect the teeth from injury.

PILULÆ FERRI IODIDI. *U. S.* Pills of Ferrous Iodide.

The liability to decomposition of ferrous iodide has led to various forms of administration which will present it unaltered. The official pills of ferrous iodide are directed to be coated with an ethereal solution of tolu to preserve them from change. The pills contain ferrous iodide, sugar, extract of glycyrrhiza, glycyrrhiza, and acacia. There is in each pill nearly one grain of ferrous iodide. Ferrous iodide is a valuable salt in diseases attended with anæmia which require the use of an alterative. The dose is one or two pills.

FERRI LACTAS. *U. S.* Ferrous Lactate.

$Fe(C_3H_5O_3)_2 + 3H_2O$; 287.34.

Preparation.—This salt may be made by the former official process: Take of Lactic Acid, 1 fl. oz.; Iron, in the form of filings, 240 grains; Distilled Water, a sufficient quantity. Mix the Acid with a pint of Distilled Water in an iron vessel, add the Iron, and digest the mixture on a water-bath, supplying Distilled Water, from time to time, to preserve the measure. When the action has ceased, filter the solution, while hot, into a porcelain capsule, and set it aside to crystallize. At the end of forty-eight hours, decant the liquid, wash the crystals with a little alcohol, and dry them on bibulous paper. By evaporating the mother-water in an iron vessel to one-half, filtering while hot, and setting the liquid aside, more crystals may be obtained.

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Lactic Acid.}}{4HC_3H_5O_3} = \underset{\text{Ferrous Lactate.}}{2Fe(C_3H_5O_3)_2} + \underset{\text{Hydrogen.}}{H_4}.$$

Ferri Lactas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
Pale, greenish-white crusts, consisting of small, needle-shaped crystals, permanent in the air. When heated on platinum foil, the salt froths up, gives out thick, white, acrid fumes, and chars, a brown-red residue being finally left.	Slight, peculiar odor; mild, sweetish, ferruginous taste; slightly acid reaction.	At 15° C. (59° F.), 40 parts. Boiling, 12 parts.	Almost insoluble.	Freely soluble in solution of an alkaline citrate, yielding a green solution.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution of the salt has a greenish-yellow color. The aqueous solution yields a blue precipitate with potassium ferricyanide T.S. The aqueous solution yields a light blue precipitate with potassium ferrocyanide T.S.	Sulphate, Citrate, Chloride, Tartrate, Malate, and of Foreign Metals.	A 2-per-cent. aqueous solution of the salt should not afford with lead acetate T.S., nor, after acidulation with hydrochloric acid, with hydrogen sulphide T.S., more than a whitish opalescence.
	Sulphate, Chloride.	The aqueous solution, acidulated with nitric acid, should not afford more than a slight opalescence with barium chloride T.S., or with silver nitrate T.S.
	Sugar.	If 25 C.c. of the aqueous solution (1 in 50), mixed with 5 C.c. of diluted sulphuric acid, be boiled for a few minutes, then precipitated by an excess of potassium or sodium hydrate T.S., the filtrate, mixed with a few drops of alkaline cupric tartrate V.S. and heated to boiling, should not afford a red precipitate.
	Butyric Acid.	If a portion of the salt be triturated with strong sulphuric acid, no offensive odor should be developed,
	Carbonate.	Nor should any gas be evolved,
	Sugar, Gum, Readily Carbonizable Impurities.	And the mixture, after standing for some time, should not assume a brown color.
	Foreign Salts.	If 1 Gm. of the salt, contained in a porcelain crucible, be moistened with nitric acid, and carefully ignited, it should leave a residue of ferric oxide weighing not less than 0.270 or more than 0.278 Gm. This residue should not have an alkaline reaction upon litmus paper, nor yield anything soluble to water.

Uses.—Ferrous lactate is used as a chalybeate because it is believed to be more readily assimilated than other iron salts. It is given in doses of one to five grains (0.06 to 0.3 Gm.).

FERRI OXIDUM HYDRATUM. *U. S.* Ferric Hydrate.

$Fe_2(OH)_6 = 213.52.$

[Ferric Hydroxide. Hydrated Oxide of Iron.]

	Metric.	Old form.
Solution of Ferric Sulphate	100 C c.	10 fl. oz.
Ammonia Water	110 C.c.	11 fl. oz.
Water, a sufficient quantity.		

To the Ammonia Water, previously diluted with 250 C.c. [old form 25 fl. oz.] of cold Water, add, under constant stirring, the Solution of Ferric Sulphate, previously diluted with 1000 C.c. [old form 100 fl. oz.] of cold Water. As soon as the precipitate has subsided, draw off the clear liquid by means of a siphon, then mix the precipitate intimately with about 1000 C.c. [old form 100 fl. oz.] of cold Water, again draw off the clear liquid after subsidence of the precipitate, and repeat this operation, until a portion of the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Finally transfer the precipitate to a wet muslin strainer, and, after it has drained, mix it with sufficient cold Water to make the mixture weigh 250 Gm. [old form 25 oz. av.].

When Ferric Hydrate is to be made in haste, for use as an antidote, the washing may be performed more quickly, though less perfectly, by transferring the precipitate at once to a wet muslin strainer, pressing forcibly with the hands, until no more liquid passes, and then adding enough Water to make the whole weigh about 250 Gm. [old form 25 oz. av.].

Note.—The ingredients for preparing Ferric Hydrate as an antidote should always be kept on hand in bottles containing, respectively, 200 C.c. [old form 6 fl. oz.] of the Solution of Ferric Sulphate, and 220 C.c. [old form 6½ fl. oz.] of Ammonia Water.

The reaction is as follows:

$$\underset{\text{Ferric Sulphate.}}{Fe_23SO_4} + \underset{\text{Ammonium Hydrate.}}{6NH_4HO} = \underset{\text{Ferric Hydrate.}}{Fe_2(HO)_6} + \underset{\text{Ammonium Sulphate.}}{3(NH_4)_2SO_4}.$$

Ammonia water is preferred as the precipitant, because an excess is easily detected by the odor, and the salt formed is easily washed out.

Uses.—This compound is used as the basis of several iron salts, citrate, tartrate, etc., and also as the antidote to poisoning by arsenic. For the latter purpose it should be administered freely. It acts by producing insoluble ferrous arsenate.

$$\underset{\text{Ferric Hydrate.}}{2Fe_2(HO)_6} + \underset{\text{Arsenous Oxide.}}{As_2O_3} = \underset{\text{Ferrous Arsenate.}}{Fe_3(AsO_4)_2} + \underset{\text{Ferrous Hydrate.}}{Fe(HO)_2} + \underset{\text{Water.}}{5H_2O}.$$

It should never be kept on hand, as it decomposes even when kept under water: the ingredients should always be kept already weighed out, placed in suitable bottles, *and in an accessible and well-known place in the store,* so that if wanted quickly it can be made without the unnecessary loss of a moment's time.

FERRI OXIDUM HYDRATUM CUM MAGNESIA. *U.S.* Ferric Hydrate with Magnesia.

[ARSENIC ANTIDOTE.]

	Metric.	Old form.
Solution of Ferric Sulphate	50 C.c.	1 fl. oz. 5¼ fl. dr.
Magnesia	10 Gm.	154 grains.
Water, a sufficient quantity.		

Mix the Solution of Ferric Sulphate with 100 C.c. [old form 3 fl. oz.] of Water, and keep the liquid in a large, well-stoppered bottle. Rub the Magnesia with cold Water to a smooth and thin mixture, transfer this to a bottle capable of holding about 1000 C.c. [old form 2 pints], and fill it with Water to about three-fourths of its capacity. When the preparation is wanted for use, shake the Magnesia mixture to a homogeneous, thin magma, add it gradually to the Iron Solution, and shake them together until a uniform, smooth mixture results.

Note.—The diluted Solution of Ferric Sulphate, and the mixture of Magnesia with Water, should always be kept on hand, ready for immediate use.

Uses.—This preparation furnishes a ready and efficient antidote against arsenous acid. Ferric hydrate is produced when the mixture of magnesia is added to the diluted solution of ferric tersulphate, and,

as the magnesia is in excess and acidity thus prevented, no harm can result from not separating the by-products of the reaction. It contains in addition magnesium sulphate and hydrate. It has been shown that no soluble compound with arsenic is formed when it is used as an antidote, and the presence of the magnesium salts, from a therapeutical point of view, is not objectionable.

FERRI PHOSPHAS SOLUBILIS. *U.S.* **Soluble Ferric Phosphate.**

	Metric.	Old form.
Ferric Citrate	50 Gm.	10 oz. av.
Sodium Phosphate, uneffloresced	55 Gm.	11 oz. av.
Distilled Water	100 C.c.	19 fl. oz.

Dissolve the Ferric Citrate in the Distilled Water by heating on a water-bath. To this solution add the Sodium Phosphate, and stir constantly until it is dissolved. Evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in dark amber-colored, well-stoppered bottles.

This is a scaled salt, and very different from the insoluble slate-colored powder of iron phosphate formerly official. It is not a definite chemical compound, but is sometimes termed sodio-ferric citrophosphate. It greatly resembles the official ferric pyrophosphate.

Ferri Phosphas Solubilis. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Thin, bright green, transparent scales, permanent in dry air when excluded from light, but becoming dark and discolored on exposure to light.	Odorless; acidulous, slightly saline taste. Slightly acid reaction.	Freely and completely.	Insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
With potassium ferrocyanide T.S. the solution gives a blue color, but does not yield a blue precipitate, unless it has been acidulated with hydrochloric acid. If 1 Gm. of the salt be boiled with 10 C.c. of potassium or sodium hydrate T.S., a reddish-brown precipitate is produced, and if the colorless filtrate from this precipitate be strongly acidulated with hydrochloric acid, then magnesia mixture added, and subsequently a slight excess of ammonia water, an abundant white, crystalline precipitate will be produced.	Pyrophosphate.	If a portion of the filtrate from this precipitate be acidulated with acetic acid, and heated to boiling, no further precipitate should be produced.

Quantitative Test.
If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be allowed to stand for half an hour at a temperature of 40° C. (104° F.), and then allowed to cool, and mixed with a few drops of starch T.S., it should require about 12 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).

Uses.—This is a mild and safe ferruginous tonic. It is given in doses of five to ten grains (0.3 to 0.6 Gm.).

FERRI PYROPHOSPHAS SOLUBILIS. *U. S.* **Soluble Ferric Pyrophosphate.**

[FERRI PYROPHOSPHAS, PHARM. 1880.]

	Metric.	Old form.
Ferric Citrate	50 Gm.	8 oz. av.
Sodium Pyrophosphate, uneffloresced	50 Gm.	8 oz. av.
Distilled Water	100 C.c.	16 fl. oz.

Dissolve the Ferric Citrate in the Distilled Water, by heating on a water-bath. To this solution add the Sodium Pyrophosphate, and stir constantly until it is dissolved. Evaporate the solution, on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in dark amber-colored, well-stoppered bottles.

This compound is a mixture of several salts,—sodio-ferric pyrophosphate, sodio-ferric citrate, and ferric citrate. It differs from the salt official in 1870, which was the insoluble ferric pyrophosphate, $Fe_43P_2O_7$, dissolved in solution of ammonium citrate: the ammonium salt is less stable than the sodium compound, being slowly decomposed on exposure to the air, and the process yielded an unsatisfactory product.

Ferri Pyrophosphas Solubilis. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Thin, apple-green, transparent scales, permanent in dry air when excluded from light, but turning dark on exposure to light. The aqueous solution of the salt is rendered blue by potassium ferrocyanide T.S., but does not yield a blue precipitate with this reagent unless it has been acidulated with hydrochloric acid.	Odorless; acidulous, slightly saline taste; slightly acid reaction.	Freely and completely soluble.	Insoluble.

TESTS FOR IDENTITY AND QUANTITATIVE TEST.

If 1 Gm. of the salt be boiled with 10 C.c. of potassium or sodium hydrate T.S., a reddish-brown precipitate will be produced, and if the colorless filtrate from this precipitate be strongly acidulated with hydrochloric acid, then magnesia mixture added, and subsequently a slight excess of ammonia water, no precipitate should be produced (distinction from and absence of *ferric phosphate*).

If a portion of the filtrate be acidulated with acetic acid, and heated to boiling, an abundant, white, flocculent precipitate (pyrophosphate) will be produced.

If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of 100 C.c.) in 10 C.c. of water, then 10 C.c. of hydrochloric acid and subsequently 40 C.c. of water added, and, after the addition of 1 Gm. of potassium iodide, the mixture be allowed to stand for half an hour at a temperature of 40° C. (104° F.), and then allowed to cool, and mixed with a few drops of starch T.S., it should require about 10 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).

Uses.—This is one of the best of the mild ferruginous preparations. It is very largely used on account of its solubility and the ease with

which it can be administered either in pills or in solution. The dose is two to five grains (0.13 to 0.3 Gm.).

FERRI SULPHAS. *U. S.* Ferrous Sulphate.

$FeSO_4 + 7H_2O$; 277.42.

Preparation.—This salt is rarely made by the pharmacist, because the commercial article is furnished much more cheaply than the salt made on the small scale. The following is the British process:

Take of Iron Wire 4 oz. av.; Sulphuric Acid 4 fl. oz. [Imperial measure]; Distilled Water 1½ pints [Imp. meas.]. Pour the Water on the Iron placed in a porcelain dish, add the Sulphuric Acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and be preserved in a stoppered bottle.

The salt is a by-product in the manufacture of hydrogen, the following being the reaction:

$$\underset{\text{Iron.}}{Fe_2} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Ferrous Sulphate.}}{2FeSO_4} + \underset{\text{Hydrogen.}}{4H.}$$

Ferri Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Large, pale bluish-green, monoclinic prisms, efflorescent in dry air, and absorbing oxygen rapidly on exposure to air, becoming coated with brownish-yellow, basic ferric sulphate. When slowly heated to 115° C. (239° F.), the crystals fall to powder and lose 38.84 per cent. of their weight (6 molecules of water of crystallization).	Odorless; saline, styptic taste; acid reaction.	At 15° C. (59° F.), 1.8 parts. Boiling, 0.3 part.	Insoluble.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The aqueous solution of the salt affords a blue precipitate of potassium ferricyanide T.S., and a white precipitate, insoluble in hydrochloric acid, with barium chloride T.S. If 1.39 (1.3871) Gm. of the salt be dissolved in about 25 C.c. of water, and the solution acidulated with sulphuric acid, not less than 50 C.c. of decinormal potassium permanganate V.S. should be required to impart to the liquid a permanent pink color (each C.c. of the volumetric solution indicating 2 per cent. of crystallized Ferrous Sulphate).	Copper, Zinc, etc.	If 1 Gm. of the salt be dissolved in about 25 C.c. of water, the solution heated to boiling, oxidized with nitric acid, and then a slight excess of ammonia water added, the filtrate from the reddish-brown precipitate should be colorless, and should not be affected by hydrogen sulphide T.S.
	Limit of the Salts of the Fixed Alkalies.	If another portion of the filtrate be evaporated to dryness and then ignited, it should not leave more than a trace of residue.

Uses.—This is a very astringent iron salt. When used internally, the exsiccated salt is preferred. The impure ferrous sulphate, called

copperas,[1] is used as a disinfectant. The dose of the sulphate is one to two grains (0.06 to 0.13 Gm.).

FERRI SULPHAS EXSICCATUS. *U.S.* Dried Ferrous Sulphate.

Approximately $2FeSO_4 + 3H_2O = 357.28.$

	Metric.	Old form.
Ferrous Sulphate, in coarse powder	100 Gm.	25 oz. av.

Allow the salt to effloresce at a temperature of about 40° C. (104° F.), and then heat it in a porcelain dish, on a water-bath, constantly stirring, until the product weighs from 64 to 65 Gm. [old form 16 oz. av.]. Lastly, reduce the residue to a fine powder, and transfer it at once to perfectly dry, well-stoppered bottles.

This process does not deprive the ferrous sulphate of all its water of crystallization, about 15 per cent. being retained. One hundred parts of crystallized sulphate yield about 64 per cent. of the dried salt.

Uses.—Dried ferrous sulphate is a grayish-white powder, and is principally used in making pills, the crystallized sulphate being unfitted for the purpose on account of the large proportion of water that it contains. Five grains of the crystals are represented by three grains of the dried sulphate. It is used in the official pills of aloes and iron.

FERRI SULPHAS GRANULATUS. *U.S.* Granulated Ferrous Sulphate.

$FeSO_4 + 7H_2O = 277.42.$

[FERRI SULPHAS PRÆCIPITATUS, PHARM. 1880.]

	Metric.	Old form.
Ferrous Sulphate	100 Gm.	4 oz. av.
Distilled Water	100 C.c.	4 fl. oz.
Diluted Sulphuric Acid	5 C.c.	1¼ fl. dr.
Alcohol	25 C.c.	1 fl. oz.

Dissolve the Ferrous Sulphate in the Distilled Water previously heated to boiling, add the Diluted Sulphuric Acid, and filter the solution while hot. Evaporate the solution immediately in a tared porcelain capsule, on a sand-bath, until it weighs 150 Gm. [old form 6 oz. av.], and then cool it quickly, under constant stirring. Transfer the product to a glass funnel stopped with a plug of absorbent cotton, and, when it has thoroughly drained, pour upon it the Alcohol. When this also has drained, spread the crystalline powder on bibulous paper, dry it quickly in the sunlight, or in a dry room, at the ordinary temperature, and transfer it at once to perfectly dry, well-stoppered bottles.

Ferrous sulphate is insoluble in alcohol; hence, if a strong aqueous solution is poured into alcohol, it is precipitated in the form of a granular crystalline powder, and this method was used in the U.S.P. 1880 for procuring this salt. The U.S.P. 1890 process differs from that formerly official in that the sulphate is not precipitated but gran-

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[1] This unfortunate synonyme, "*copperas*," has led to a great many errors, through the impression that this salt must contain copper. It is often confounded with the poisonous salt copper sulphate, or blue vitriol, and they have been substituted for each other. (See Synonymes, page 31.)

ulated, and subsequently washed with alcohol to free it from impurities. The present method, in our opinion, is not an improvement, but is probably better adapted for large operations.

Uses.—Granulated ferrous sulphate should be used in preference to the large crystals at the prescription counter; the precipitation in alcohol not only furnishes it in a convenient form, but the soluble impurities are washed out. It is much less liable to oxidation and change than the ordinary crystallized sulphate.

FERRI VALERIANAS. *U. S.* Ferric Valerianate.

Preparation.—Ferric valerianate may be made by mixing solutions of ferric sulphate and sodium valerianate: double decomposition results in the precipitation of ferric valerianate, whilst sodium sulphate remains in solution.

Ferri Valerianas. *U. S.*	Odor and Taste.	Solubility.	
		Water.	Alcohol.
A dark, brick-red, amorphous powder, of somewhat varying chemical composition, permanent in dry air.	Odor of valerianic acid; mildly styptic taste.	Cold, Insoluble. Boiling, Is decomposed, setting free the valerianic acid and leaving ferric hydrate.	Readily insoluble.

Tests for Identity and Quantitative Test.
When slowly heated, the salt parts with its acid, without fusing, but when rapidly heated it fuses and gives off inflammable vapors having the odor of butyric acid. On ignition, ferric oxide remains. The stronger acids decompose the Valerianate, liberating valerianic acid.
If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 C.c.) in 2 C.c. of hydrochloric acid and 15 C.c. of water, and after the addition of 1 Gm. of potassium iodide the mixture be allowed to stand for half an hour at a temperature of 40° C. (104° F.), then allowed to cool, and mixed with a few drops of starch T.S., it should require not less than 15 nor more than 20 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 1 per cent. of metallic iron).

Uses.—This salt is of very little use in pharmacy or medicine: it is rarely prescribed. The dose is one to ten grains (0.06 to 0.6 Gm.).

LIQUOR FERRI ACETATIS. *U. S.* Solution of Ferric Acetate.

An aqueous solution of Ferric Acetate [$Fe_2(C_2H_3O_2)_6 = 464.92$], containing about 31 per cent. of the anhydrous salt, and corresponding to about 7.5 per cent. of metallic iron.

	Metric.	Old form.
Solution of Ferric Sulphate	1000 Gm.	14½ fl. oz.
Glacial Acetic Acid	260 Gm.	4¾ fl. oz.
Ammonia Water	850 C.c.	16 fl. oz.
Water,		
Distilled Water, each, a sufficient quantity,		
To make	1000 Gm.	1 pint.

Mix the Ammonia Water with 3000 C.c. [old form 3 pints] of cold Water, and the solution of Ferric Sulphate with 10000 C.c. [old form 10 pints] of cold Water. Add the latter solution slowly to the diluted Ammonia Water, stirring constantly. Let the mixture stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate 6000 C.c. [old form 6 pints] of boiling Water, mix well, and again set the mixture aside, as before. Repeat the washing with successive portions of boiling Water, in the same manner, until the washings are no longer affected by sodium cobaltic nitrite test-solution (showing the removal of ammonia and its salts. Transfer the mixture to a wet muslin strainer, allow the precipitate to drain completely, and press it, folded in the strainer, until its weight is reduced to 700 Gm. [old form 14 oz. av.] or less. Now add the precipitate gradually to the Glacial Acetic Acid contained in a tared jar provided with a glass stopper, stirring the mixture after each addition until each portion added is nearly dissolved before adding another portion. Finally, add enough Distilled Water to make the product weigh 1000 Gm. [or measure, old form, 1 pint], mix thoroughly, allow it to become clear by subsidence, and decant the clear solution.

Keep the product in well-stoppered bottles, in a cool place, protected from light.

Liquor Ferri Acetatis. *U. S.*	Odor, Taste, and Reaction.
A dark reddish-brown, transparent liquid. Sp. gr. about 1.160 at 15° C. (59° F.).	Acetous odor; sweetish, acidulous, faintly styptic taste; slightly acid reaction.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
The diluted Solution affords a brownish-red precipitate with ammonia water, and a blue precipitate with potassium ferrocyanide T.S. When heated to boiling, the Solution yields a brownish-red precipitate, and when heated with sulphuric acid, the Solution evolves acetous vapors.	Zinc, Copper.	If the iron be completely precipitated from a portion of the Solution by an excess of ammonia water, a portion of the filtrate should not yield a white or a dark-colored precipitate with hydrogen sulphide T.S.
If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then allowed to cool, and mixed with a few drops of starch T.S., it should require about 15 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution consumed representing 0.5 per cent. of metallic iron).	Salts of the Fixed Alkalies.	The Solution, after the iron has been completely precipitated from it by an excess of ammonia water, should leave no fixed residue on evaporation and gentle ignition.
	Ferrous Salt.	If to a small portion of the Solution, diluted with about 10 volumes of water, a few drops of freshly prepared potassium ferrocyanide T.S. be added, it should impart to it a pure brown color without a trace of blue.

Uses.—This solution has been made official. The dose is five minims (0.3 C.c.).

LIQUOR FERRI ET AMMONII ACETATIS. *U. S.* Solution of Iron and Ammonium Acetate.

[MISTURA FERRI ET AMMONII ACETATIS, PHARM. 1880. BASHAM'S MIXTURE.]

	Metric.	Old form.
Tincture of Ferric Chloride	20 C.c.	2 fl. dr.
Diluted Acetic Acid	30 C.c.	8 fl. dr.
Solution of Ammonium Acetate	200 C.c.	2½ fl. oz.
Aromatic Elixir	100 C.c.	1¼ fl. oz.
Glycerin	120 C.c.	1½ fl. oz.
Water, a sufficient quantity,		
To make	1000 C.c.	12½ fl. oz.

To the Solution of Ammonium Acetate (which should not be alkaline) add, successively, the Diluted Acetic Acid, the Tincture of Ferric Chloride, the Aromatic Elixir, and the Glycerin, and, lastly, enough Water to make the product measure 1000 C.c. [old form 12½ fl. oz.].

This preparation should be freshly made when wanted.

This solution has been improved in the U. S. P. 1890 by the addition of glycerin. It is not intended to be a permanent preparation, and in time will decompose. Some pharmacists prefer to keep in a shop bottle all the ingredients mixed together except the tincture of ferric chloride, and, when called for, add the proper quantity of the tincture to the quantity to be dispensed. In this way time is saved and a fresh preparation always furnished.

This is a mild ferruginous solution, of very pleasant taste, and is often known as Basham's mixture. It is given in doses of four fluidrachms to one fluidounce (15 to 30 C.c.).

LIQUOR FERRI NITRATIS. *U. S.* Solution of Ferric Nitrate.

An aqueous solution of Ferric Nitrate [$Fe_2(NO_3)_6 = 483.1$], containing about 6.2 per cent. of the anhydrous salt, and corresponding to about 1.4 per cent. of metallic iron.

	Metric.	Old form.
Solution of Ferric Sulphate	180 Gm.	2 fl. oz. 5 fl. dr.
Ammonia Water	160 C.c.	3 fl. oz.
Nitric Acid	71 Gm.	7½ fl. dr.
Distilled Water,		
Water, each, a sufficient quantity,		
To make	1000 Gm.	20 oz. av.

Mix the Ammonia Water with 500 C.c. [old form 8 fl. oz.] of cold Water, and the Solution of Ferric Sulphate with 1500 C.c. [old form 24 fl. oz.] of cold Water. Add the latter solution slowly to the diluted Ammonia Water, with constant stirring. Let the mixture stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate 1000 C.c. [old form 16 fl. oz.] of cold Water, mix well, and again set the mixture aside, as before. Repeat the washing with successive portions of cold Water, in the same manner, until the washings produce but a slight cloudiness with barium chloride test-solution. Pour the washed ferric hydrate on a wet muslin strainer, and let it drain thoroughly. Then transfer

it to a porcelain capsule, add the Nitric Acid, and stir with a glass rod, until a clear solution is obtained. Finally, add enough Distilled Water to make the finished product weigh 1000 Gm. [old form 20 oz. av.]. Filter, if necessary.

Liquor Ferri Nitratis. U.S.	Tests for Identity and Quantitative Test.
A transparent, amber-colored or reddish liquid, without odor, having an acid, strongly styptic taste, and an acid reaction. Sp. gr. 1.050 at 15° C. (59° F.). The Solution affords a brown-red precipitate with ammonia water, and a blue precipitate with potassium ferrocyanide T.S.	If a clear crystal of ferrous sulphate be added to a cooled mixture of equal volumes of concentrated sulphuric acid and of the Solution, the crystal rapidly becomes brown and surrounded by a brownish-black zone. If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 2.8 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).

Uses.—This solution is tonic and astringent. It is given in doses of five to ten minims (0.3 to 0.6 C.c.).

LIQUOR FERRI SUBSULPHATIS. *U. S.* Solution of Ferric Subsulphate.

[Solution of Basic Ferric Sulphate. Monsel's Solution.]

An aqueous solution of Basic Ferric Sulphate (of variable chemical composition), corresponding to about 13.6 per cent. of metallic iron.

	Metric.	Old form.
Ferrous Sulphate, in clear crystals	675 Gm.	16 oz. av. 628 gr.
Sulphuric Acid	65 Gm.	7 fl. dr.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	1000 Gm.	1 pint.

Add the Sulphuric Acid to 500 C.c. [old form 7 fl. oz.] of Distilled Water in a capacious porcelain capsule, heat the mixture to nearly 100° C. (212° F.), then add 65 Gm. [old form 1 fl. oz. 1 fl. dr.] of Nitric Acid, and mix well. Divide the Ferrous Sulphate, coarsely powdered, into four equal portions, and add these portions, one at a time, to the hot liquid, stirring after each addition until effervescence ceases. When all of the Ferrous Sulphate is dissolved, add a few drops of Nitric Acid, and, if this causes a further evolution of red fumes, continue to add Nitric Acid, a few drops at a time, until it no longer causes red fumes to be evolved; then boil the Solution until it assumes a ruby-red color and is free from nitrous odor. Lastly, add enough Distilled Water to make the product weigh 1000 Gm. [or measure, old form, 1 pint]. Keep the product in well-stoppered bottles, in a moderately warm place (not under 22° C., or 71.6° F.), protected from light.

This solution will sometimes crystallize, forming a semi-solid, whitish mass. When this occurs, the application of a gentle heat to the bottle will restore the liquid condition.

Note.—Solution of Ferric Subsulphate is to be dispensed when Solution of Persulphate of Iron has been prescribed by the physician.

When ferrous sulphate is added to a hot mixture of nitric and sulphuric acids, a copious evolution of reddish-yellow vapors of nitrogen tetroxide takes place, and the iron assumes a blackish tint, due to the formation of a compound of the ferrous sulphate with the nitric oxide. This black color disappears under the influence of heat, and, when effervescence ceases, the dark reddish-brown liquid is left which is widely known as *Monsel's Solution* (see Liquor Ferri Tersulphatis).

Liquor Ferri Subsulphatis. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A dark reddish-brown liquid. Sp. gr. about 1.550 at 15° C. (59° F.). The diluted Solution affords a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in hydrochloric acid, with barium chloride T.S.	Odorless, or nearly so; extremely astringent taste; acid reaction.	Miscible, in all proportions, with water and alcohol without decomposition.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
On slowly mixing 2 volumes of the Solution with 1 volume of concentrated sulphuric acid, in a beaker, the mixture separates a solid, white mass on standing (difference from *tersulphate*). If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 27.2 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).	Nitric Acid.	On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a diluted portion of the Solution, the crystal should not become brown, nor should there be a brownish-black color developed around it.
	Ferrous Salt.	A few drops added to freshly prepared potassium ferricyanide T.S. should impart to it a pure brown color, without a trace of green or greenish-blue.

Uses.—This preparation is probably the most valuable official styptic solution. It is less irritating than the solution of the tersulphate, owing to the smaller proportion of sulphuric acid. It is used externally in stopping hemorrhages, and internally in doses of three to six minims (0.18 to 0.37 C.c.), largely diluted with water.

LIQUOR FERRI TERSULPHATIS. *U. S.* Solution of Ferric Sulphate.

An aqueous solution of normal Ferric Sulphate [$Fe_2(SO_4)_3 = 399.2$], containing about 28.7 per cent. of the salt, and corresponding to about 8 per cent. of metallic iron.

	Metric.	Old form.
Ferrous Sulphate, in clear crystals	400 Gm.	8 oz. 350 gr.
Sulphuric Acid	78 Gm.	7 fl. dr. 10 min.
Nitric Acid,		
Distilled Water, each, a sufficient quantity,		
To make	1000 Gm.	1 pint.

Add the Sulphuric Acid to **200** C.c. [old form 3 fl. oz.] of Distilled Water in a capacious porcelain capsule, heat the mixture to nearly 100° C. (212° F.), then add **55** Gm. [old form $6\frac{1}{2}$ fl. dr.] of Nitric Acid, and mix well. Divide the Ferrous Sulphate, coarsely powdered, into four equal portions, and add these portions, one at a time, to the hot liquid, stirring after each addition until effervescence ceases. When all of the Ferrous Sulphate is dissolved, add a few drops of Nitric Acid, and, if this causes a further evolution of red fumes, continue to add Nitric Acid, a few drops at a time, until it no longer causes red fumes to be evolved; then boil the Solution until it assumes a reddish-brown color and is free from nitrous odor. Lastly, add enough Distilled Water to make the product weigh **1000** Gm. [or measure, old form, 1 pint]. Filter, if necessary.

This solution differs from the solution of ferric subsulphate merely in containing a larger proportion of sulphuric acid. It has the sp. gr. 1.320, and is a solution of the *true* persulphate $Fe_2(SO_4)_3$, or normal ferric sulphate. Solution of persulphate of iron is the name under which Monsel's solution is erroneously prescribed. The latter is a solution of a subsalt, $Fe_4O(SO_4)_5$. The reaction is as follows:

$$\underset{\substack{\text{Ferrous}\\ \text{Sulphate.}}}{6FeSO_4} + \underset{\substack{\text{Sulphuric}\\ \text{Acid.}}}{3H_2SO_4} + \underset{\substack{\text{Nitric}\\ \text{Acid.}}}{2HNO_3} = \underset{\substack{\text{Ferric}\\ \text{Sulphate.}}}{3(Fe_23SO_4)} + \underset{\substack{\text{Nitrogen}\\ \text{Dioxide.}}}{2NO} + \underset{\text{Water.}}{4H_2O}.$$

Liquor Ferri Tersulphatis. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
'A dark reddish-brown liquid. Specific gravity, about 1.320 at 15° C. (59° F.). The diluted solution affords a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in hydrochloric acid, with barium chloride T.S.	Almost odorless; acid, strongly styptic taste; acid reaction.	Miscible, in all proportions, without decomposition.	Miscible, in all proportions, without decomposition.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On slowly mixing 2 volumes of the Solution with 1 volume of concentrated sulphuric acid, in a beaker, the mixture does not separate a solid, white mass on standing (difference from *subsulphate*). If 1.12 (1.1176) Gm. of the Solution be introduced into a glass-stoppered bottle (having a capacity of about 100 C.c.), together with 15 C.c. of water and 2 C.c. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 16 C.c. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each C.c. of the volumetric solution indicating 0.5 per cent. of metallic iron).	Nitric Acid.	On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately diluted portion of the Solution, the crystal should not become brown, nor should there be a brownish-black color developed around it.
	Ferrous Salt.	A few drops added to freshly prepared potassium ferricyanide T.S. should impart to it a pure brown color without a trace of green or greenish-blue.

Uses.—This solution is largely used in pharmacy in preparing ferric hydrate through precipitation with ammonia. From this many of the

iron salts and solutions are made. It is not used medicinally to any great extent, the solution of the subsulphate being preferred.

Chromium. Cr; 52.0.

Chromium occurs in nature as chrome-iron ore, large deposits of which are found in Southeastern Pennsylvania. This metal is brittle, of a grayish-white color, and very hard, being capable of scratching glass. It forms five compounds with oxygen: 1. Monoxide, or *chromous oxide*, CrO. 2. *Trichromic tetroxide*, Cr_3O_4. 3. Sesquioxide, or *chromic oxide*, Cr_2O_3. 4. Dioxide, CrO_2. 5. *Chromium trioxide*, CrO_3. The latter alone and its salts are of pharmaceutical interest.

Tests for Chromium Salts.

1. Ammonium sulphide precipitates from solutions of chromium salts a greenish precipitate of chromic hydroxide.
2. Sodium or potassium hydrate also produces a precipitate of chromic hydroxide, soluble in excess.
3. Soluble lead salts produce yellow precipitates of lead chromate (chrome yellow).

Official Preparations containing Chromium.

Official Name.	Preparation.
Acidum Chromicum . .	Made by decomposing potassium bichromate with sulphuric acid.
Potassii Bichromas . . .	Made by removing one-half of the potassium from potassium chromate with sulphuric acid, evaporating and crystallizing (see page 531).

Unofficial Preparations of Chromium.

Chromii Bromidum, Cr_2Br_6. Chromium Bromide.	By passing bromine vapor over an ignited mixture of chromic oxide with charcoal and starch paste.
Chromii Dichloridum, $CrCl_2$. Chromium Dichloride.	By passing dry chlorine gas over a red-hot mixture of charcoal and chromic oxide.
Chromii Fluoridum, Cr_2Fl_6. Chromium Fluoride.	By treating chromic oxide, dried, but not ignited, with excess of hydrofluoric acid, and heating the dried mass very strongly in a platinum crucible.
Chromii Iodidum, Cr_2I_6. Chromium Iodide.	By treating silver chromate with hydriodic acid and alcohol.
Chromii Sulphas, $Cr_2(SO_4)_3.5H_2O$. Chromium Sulphate (Green).	By dissolving chromic oxide in strong sulphuric acid at a temperature between 50° and 60° C.

ACIDUM CHROMICUM. *U. S.* Chromic Acid.

CrO_3; 99.88.

[CHROMIC TRIOXIDE. CHROMIC ANHYDRIDE.]

Preparation.—Chromic acid is readily obtained by mixing one hundred measures of a cold saturated solution of potassium bichromate with one hundred and fifty measures of sulphuric acid, and allowing the mixture to cool. The sulphuric acid unites with the potassium, and sets free the chromic anhydride, which is deposited in crystals. The mother-liquor having been poured off, these are transferred to a glass funnel, and the mother-liquor displaced by nitric acid; they are

then placed upon a tile to drain, covered with a glass bell-jar. Chromic acid should be preserved in glass-stoppered vials.

$$\underset{\text{Potassium Bichromate.}}{K_2Cr_2O_7} + \underset{\text{Sulphuric Acid.}}{2H_2SO_4} = \underset{\text{Chromic Acid.}}{2CrO_3} + \underset{\text{Potassium Acid Sulphate.}}{2KHSO_4} + \underset{\text{Water.}}{H_2O}$$

Acidum Chromicum. *U.S.*	Odor and Reaction.	Solubility.	
		Water.	Alcohol, etc.
Small, dark purplish-red, needle-shaped or rhombic crystals of a metallic lustre; deliquescent in moist air; destructive to animal and vegetable tissues.	Odorless.	Very soluble, forming an orange-red solution.	Brought in contact with alcohol, ether, glycerin, and other organic solvents, decomposition takes place, sometimes with dangerous violence.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated, its color darkens, and finally becomes black, but is restored on cooling. At 192° to 193° C. (377.6° to 379.4° F.) it fuses to a reddish-brown liquid, which, on cooling, forms a dark red, brittle mass, furnishing a scarlet powder; above 250° C. (482° F.) it is mostly decomposed, with the formation of dark green chromic oxide and the evolution of oxygen; after protracted heating, it leaves a residue of pure chromic oxide, which should yield nothing soluble to water.	Sulphuric Acid.	If 1 Gm. of the acid be dissolved in 100 C.c. of cold water and mixed with a few C.c. of hydrochloric acid, the further addition of 1 C.c. of barium chloride T.S. should not render the solution turbid.

Uses.—Chromic acid, or, more properly, *chromic anhydride*, is a powerful caustic and antiseptic: it parts with its combined oxygen with great facility. It is a very effective caustic in destroying warty growths. Care must be used, in mixing it with glycerin, sugar, tannin, acid, alcohol, cork, or similar deoxidizing bodies, to avoid explosions. It is not used internally.

QUESTIONS ON CHAPTER XLIV.

MANGANESE, IRON, AND CHROMIUM.

Manganese—Give Latin name, symbol, and atomic weight.
How is it found?
How many compounds does it form with oxygen?
Give their names and chemical composition.
What are the tests for the salts of manganese?
Manganese dioxide—What is it?
How much per cent. of pure manganese dioxide does it contain?
Does the commercial article always contain this much?
How may its quality be tested?
Describe odor, taste, and chemical reaction.
Manganese sulphate—Give Latin name, formula in symbols, and molecular weight.
Give Prof. Diehl's process for making this salt.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Zinc; iron; copper; alkalies or magnesia.

What is the dose?

Potassium permanganate—Give Latin name.

Iron—Give Latin name, symbol, and atomic weight.

With which of the non-metallic elements does it not combine?

What compounds does it form with oxygen?

What are the tests for iron salts?

In what form is iron official?

Reduced iron—Give Latin name.

Describe Prof. Procter's process for making it.

How may its quality be tested?

Describe odor, taste, and chemical reaction.

Saccharated ferrous carbonate—Give Latin name. What is the dose?

How is it prepared? Give rationale of process.

Describe odor, taste, chemical reaction, and solubility.

How may impurity of sulphate be detected?

What is the dose?

Mass of ferrous carbonate—Give Latin name.

What was the title of this preparation in the U. S. P. 1870?

How is it made? Describe rationale of process.

What are syrup and honey used for in this preparation?

What is a common or popular name for it?

Compound iron mixture—Give Latin name.

Upon what ingredient does the usefulness of this depend?

Compound pills of iron—Give Latin name.

What is the composition of one of these pills?

Ferric chloride—Give Latin name, formula in symbols, and molecular weight.

Is this a ferrous or a ferric salt?

How is it made? Describe rationale of process.

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Zinc and copper; fixed alkalies; nitric acid; ferrous salt; oxychloride.

What is the dose?

Solution of ferric chloride—Give Latin name.

How much anhydrous ferric chloride does it contain?

How is it made?

If this solution when finished has a blackish color, what is indicated? What is the remedy?

If a brown precipitate occurs upon dilution or standing, what is indicated? What is the remedy?

Describe rationale of process.

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Zinc, copper; fixed alkalies; nitric acid; ferrous salt; oxychloride.

What are its uses?

Tincture of ferric chloride—Give Latin name.

How is this tincture prepared?

What is the object of allowing the mixture to stand three months before it is to be used?

If a brownish-red precipitate occurs upon diluting the solution of ferric chloride, what is indicated? What is the dose?

Ferric citrate—Give Latin name.

How is it prepared?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may impurities of fixed alkalies be detected?

What is the dose?

Iron and ammonium citrate—Give Latin name.

How is it prepared?

What is Lloyd's modification of this process?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Fixed alkalies.

What is the dose?

Solution of ferric citrate—What is its Latin official name?

How much anhydrous ferric citrate does it contain?

How is it prepared? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the strength of this preparation as compared with the scaled salt?
What is the dose?
Wine of ferric citrate—What is the Latin name?
How is it made? What is the dose?
Iron and quinine citrate—Give Latin name.
How is it prepared?
To what is the green color of the salt as frequently found in the market owing?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may its quality be tested?
What is the dose?
Soluble iron and quinine citrate—How is this prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How much quinine should it contain?
How may its quality be tested?
How is bitter wine of iron made? What is the dose?
Iron and strychnine citrate—How is this salt prepared?
How much strychnine does it contain?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Syrup of iron, quinine, and strychnine phosphates—What is the Latin name?
How is it made?
What is a common or popular name for it?
What is the dose?
Ferric ammonium sulphate—Give Latin name, formula in symbols, and molecular weight.
What is its synonyme?
Describe the process (formerly official) by which it may be made.
With how many molecules of water does the salt crystallize?
Is it a stable compound?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of aluminum be detected?
What is its use?
Iron and ammonium tartrate—How is it made?
What is its chemical composition, theoretically?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of fixed alkalies be detected?
How is iron and potassium tartrate made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
What is "Boule de Mars," and how is it used?
Ferric hypophosphite—Give Latin name, formula in symbols, and molecular weight. Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Ferric phosphate; calcium.
What is the dose?
Saccharated ferrous iodide—Give Latin name.
How is it made?
Is it liable to change on keeping? What change takes place?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Salts or alkalies; free iodine.
Syrup of ferrous iodide—How much ferrous iodide does it contain?
How is it made?
What is the object of exposing this syrup to the light?
What is the dose, and how should it be taken?
How are pills of iodide of iron prepared to preserve them from change?
How much ferrous iodide is there in each pill?
What is the dose?
Ferrous lactate—Give Latin name, formula in symbols, and molecular weight.
Describe the process (formerly official) for making it. Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Sulphate; citrate; tartrate.
What is the dose?

Ferric hydrate—How is it prepared?
What is the advantage of keeping the ingredients on hand?
Why is ammonia preferred to other alkalies as a precipitant?
For what purposes is it used?
When used as an antidote to poisoning by arsenic, how does it act?
Does this preparation keep well?
Ferric hydrate with magnesia—How is it made?
What is its use, and what are its advantages?
Soluble ferric phosphate—How is it made?
Is this a definite chemical compound?
What other salt does it closely resemble?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Ferric pyrophosphate—How is this made?
What is this salt chemically?
In what respect does it differ from the salt which was formerly official?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
—Ferric sulphate—Give Latin name, formula in symbols, and molecular weight.
What is the British process for making this salt?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
How may the following impurities be detected?—viz.: Ferric salt; copper.
What is the popular name of the impure ferrous sulphate?
How much water of crystallization do the crystals contain?
Dried ferrous sulphate—Give Latin name, formula in symbols, and molecular weight.
How is it prepared?
How many parts of the dried salt will one hundred parts of the crystallized salt make?
Granulated ferrous sulphate—Give Latin name, formula in symbols, and molecular weight.
Does this differ in composition from "ferri sulphas"?
How is it prepared?
What is the use of alcohol in this formula?
What advantages does this powder possess over the ordinary form of crystals?
Describe odor, taste, chemical reaction, and solubility.
How may its quality be tested?
Ferric valerianate—Give Latin name, formula in symbols, and molecular weight.
How may this salt be made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Solution of ferric acetate—Give Latin name.
How much anhydrous ferric acetate does it contain?
Ferric acetate—Give formula in symbols and molecular weight.
How is the solution prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc or copper; fixed alkalies; ferrous salt.
What is the dose?
Solution of iron and ammonium acetate—What is the Latin name?
How is it made? What is its popular name?
Is this preparation properly named? Why?
What should it be called?
What is the dose?
Solution of ferric nitrate—Give Latin name.
How much anhydrous ferric nitrate does it contain?
Ferric nitrate—Give the formula in symbols and the molecular weight.
How is the solution made? Give description and specific gravity.
Describe odor, taste, and chemical reaction.
What is the dose?
How may its quality be estimated?
Solution of ferric subsulphate—Give Latin name.
What synonymes has this solution?
How much basic ferric sulphate does it contain?

How is it prepared? Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Nitric acid; ferrous salt.
What is the dose?
Solution of ferric tersulphate—What is the Latin name?
What sulphate of iron does this solution contain, and how much?
How is it made? Describe rationale of process.
Wherein does this solution differ from the solution of ferric subsulphate?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Nitric acid; ferrous salt.
For what is this solution used?
Chromium—What is its formula in symbols? What is its molecular weight?
How does it occur in nature, and whence is it obtained?
What compounds does it form with oxygen?
What are the tests for chromium salts?
Chromic acid—What is the Latin name?
What is its formula in symbols? What is its molecular weight?
How is it obtained? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of sulphuric acid be detected?
What are its uses?
Why should care be used in mixing it with deoxidizing bodies?

CHAPTER XLV.

NICKEL, COBALT, AND TIN.

Ni; 58.6. Co; 58.6. Sn; 118.8.

NEITHER of these metals nor any of their compounds are considered of sufficient medicinal importance to give them a place in the U. S. Pharmacopœia. Their salts are sometimes used medicinally, and two of the metals are important in many respects, particularly in the arts.

Nickel. Ni; 58.6.

This metal is found in magnetic pyrites in Pennsylvania; also as arsenic or *kupfernickel* in Germany and Sweden, and as a silicate in New Caledonia. Its sp. gr. is 8.9. It is a white, malleable metal, and forms with copper a valuable alloy, known as German silver. This alloy is also used for making coins. Salts of nickel are very largely employed in electro-plating, and have come into use as medicines; the Latin name of the metal is *Niccolum*.

Tests for Compounds of Nickel.

1. Ammonium sulphide produces with a solution of a nickel salt a black precipitate (sulphide), insoluble in diluted hydrochloric acid, but soluble in hot nitric acid.

2. Potassium or sodium hydrate produces with nickel salts pale green precipitates of hydroxide insoluble in an excess.

3. Potassium cyanide produces a green precipitate with a solution of a nickel salt, soluble in an excess, but reprecipitated by hydrochloric acid.

Unofficial Salts of Nickel.

Niccoli Bromidum, $NiBr_2$. Nickel Bromide.	By dissolving nickel carbonate in hydrobromic acid, concentrating, then crystallizing.
Niccoli Carbonas, $NiCO_3$. Nickel Carbonate.	By heating nickel chloride with an alkaline carbonate in sealed tubes and collecting the powder.
Niccoli Chloridum, $NiCl_2$. Nickel Chloride.	By heating nickel filings to low redness in a stream of chlorine.
Niccoli Cyanidum, $NiCN_2$. Nickel Cyanide.	By adding to a solution of potassium cyanide a solution of any nickel salt in slight excess and collecting the precipitate.
Niccoli Sulphas, $NiSO_4.7H_2O$. Nickel Sulphate.	By dissolving pure nickel carbonate in diluted sulphuric acid, concentrating the solution, then crystallizing.

Cobalt. Co; 58.6.

This metal is usually found associated with arsenical ores. It is white, tough, and brittle, unalterable in the air, and strongly magnetic. Sp. gr. 8.5. It forms two classes of salts, cobaltous and cobaltic, in this respect resembling iron. The native ore *skutterudite*,

$CoAs_3$, and other cobalt minerals containing arsenic, are often sold in commerce under the name of *flystone*. It is used as a fly-poison by breaking it into small fragments and mixing them with sweetened water. The *chloride* and *sulphocyanate* have been used to make *barometer paper*, by dipping ordinary white paper into a solution and drying it: when dry the color is blue, but an increase of moisture in the air changes the color to pink.

Cobalt forms no official salts, and none of the unofficial salts are of pharmaceutical interest.

Tests for Salts of Cobalt.

1. Ammonium sulphide produces in a solution of a cobaltous salt a black precipitate (sulphide), insoluble in diluted hydrochloric acid.
2. Solution of potassa produces with a solution of a cobaltous salt a blue precipitate, changing by heat first to a violet and subsequently to a red color.
3. Potassium cyanide produces a yellowish-brown precipitate, soluble in an excess; the clear solution after being boiled does not afford a precipitate with hydrochloric acid (difference from nickel salts).

Tin. Sn; 118.8.

The sulphide and oxide are the forms in which tin is usually found. Tin is a valuable white metal, of a silvery color, which, when bent, emits a peculiar crackling sound. Its sp. gr. is 7.3. It forms two classes of compounds, called *stannous* and *stannic* salts. These are not used to any extent in medicine or pharmacy, but are of great importance in the arts.

Tests for Compounds of Tin.

1. Potassium or sodium hydrate produces in a solution of a salt of tin a white precipitate (hydroxide), soluble in an excess.
2. Ammonia water produces a white precipitate (hydroxide) with a solution of a stannous salt, nearly insoluble in an excess. The same reagent with a stannic salt produces a similar white precipitate (hydroxide), slightly soluble in an excess.
3. Ammonium sulphide produces in solutions of stannous salts a brownish-black precipitate, soluble in an excess (if an excess of sulphur be present in the reagent). The yellow sulphide is precipitated from this solution on the addition of an acid. Ammonium sulphide with stannic salts produces a yellow precipitate, soluble in an excess.
4. Mercuric chloride in contact with stannous salts is reduced to mercurous chloride or metallic mercury; no change occurs when it is added to stannic salts.

Unofficial Salts of Tin.

Stanni Chloridum, $SnCl_2,2H_2O$. Stannic Chloride (tin salt).	By dissolving tin in hot hydrochloric acid.
Stanni Sulphidum, SnS.	By passing hydrogen sulphide gas into a solution of stannic chloride.
Sodii Stannas, Na_2SnO_3.	By boiling tin ore with solution of caustic soda.
Acidum Stannicum, $SnO_2,2H_2O$.	By precipitating a solution of an alkaline stannate with an acid.
Acidum Metastannicum, $5SnO_2,10H_2O$.	By acting on tin with nitric acid.

CHAPTER XLVI.

LEAD, COPPER, SILVER, AND MERCURY.

Pb; 206.4. Cu; 63.18. Ag; 107.66. Hg; 199.8.

THIS group embraces four well-known metals, which furnish compounds of great value as medicines. They are allied to one another chemically, although they differ greatly in their physical properties.

Lead. Pb; 206.4.

Lead is obtained from the native sulphide, *galena*, by roasting in a reverberatory furnace. It is often associated with silver. It is a heavy, soft, bluish metal, with a specific gravity of 11.45. Lead forms five compounds with oxygen: 1. Suboxide, Pb_2O. 2. Monoxide, PbO. 3. Sesquioxide, Pb_2O_3. 4. Dioxide, PbO_2. 5. Triplumbic tetroxide, Pb_3O_4.

Tests for Compounds of Lead.

1. Hydrogen sulphide or ammonium sulphide precipitates the insoluble black sulphide from salts of lead.
2. Sulphuric acid or a sulphate causes the precipitation of the white sulphate, insoluble in nitric acid.
3. The alkaline carbonates (sodium, potassium, and ammonium) precipitate lead carbonate, insoluble in an excess.

Poisonous Properties of Lead and its Compounds.

Pure water dissolves appreciable quantities of lead through the formation of a slightly soluble hydroxide or carbonate. If traces of sulphates or chlorides be present in the water, an insoluble coating is formed on the surface of the metal, which protects it from further decomposition. Lead pipes and lead tanks for containing drinking-water should be used with care (see U. S. Dispensatory, 17th ed., page 1059).

Official Preparations of Lead.

Official Name.	Preparation.
Plumbi Acetas	Made by treating lead oxide with acetic acid, evaporating, and crystallizing.
Liquor Plumbi Subacetatis	By boiling solution of lead acetate with lead oxide.
Liquor Plumbi Subacetatis Dilutus	By diluting 30 C.c. of solution of lead subacetate with 970 C.c. of water.
Ceratum Plumbi Subacetatis	By mixing 200 Gm. of solution of lead subacetate with 800 Gm. of camphor cerate.

Official Preparations of Lead.—*Continued.*

Official Name.	Preparation.
Plumbi Carbonas	By acting on metallic lead with fumes of acetic acid and decaying matter.
Unguentum Plumbi Carbonatis	By rubbing 10 Gm. of lead carbonate with 90 Gm. of benzoinated lard.
Plumbi Iodidum	By double decomposition between lead nitrate and potassium iodide.
Unguentum Plumbi Iodidi	By rubbing 10 Gm. of lead iodide with 90 Gm. of benzoinated lard.
Plumbi Nitras	By treating lead oxide with diluted nitric acid, evaporating, and crystallizing.
Plumbi Oxidum	By roasting lead ore in reverberatory furnaces.
Unguentum Diachylon	By diluting lead plaster with olive oil and adding a little oil of lavender.
Emplastrum Plumbi	By boiling lead oxide with olive oil and water.

Unofficial Preparations of Lead.

Plumbi Binoxidum, PbO_2. Lead Dioxide.	By treating red lead with diluted nitric acid and collecting the insoluble powder.
Plumbi Bromidum, $PbBr_2$. Lead Bromide.	By making separate solutions of lead acetate and potassium bromide, mixing them, and collecting the precipitate.
Plumbi Chloridum, $PbCl_2$. Lead Chloride.	By dissolving lead acetate in water and adding hydrochloric acid, then collecting the precipitate.
Plumbi Chloris, $Pb(ClO_2)_2$. Lead Chlorite.	By making separate solutions of lead nitrate and neutral calcium chlorite, mixing them, and collecting the precipitate.
Plumbi Chromas, $PbCrO_4$. Lead Chromate.	By making separate solutions of lead nitrate and potassium bichromate, mixing them, and collecting the precipitate.
Plumbi Oxidum Rubrum, Pb_3O_4. Red Lead Oxide.	By heating massicot to near 450° C. (840° F.); it gradually combines with the oxygen of the air, which converts it into red lead.
Plumbi Saccharas. Lead Saccharate.	By saturating a solution of saccharic acid in water with freshly precipitated lead carbonate gradually added.
Plumbi Sulphas, $PbSO_4$. Lead Sulphate.	By dissolving lead nitrate in water and adding sulphuric acid, then collecting the precipitate.
Plumbi Tannas. Lead Tannate.	By adding a solution of tannin to one of lead acetate and collecting the precipitate.

PLUMBI ACETAS. *U. S.* Lead Acetate.

$Pb(C_2H_3O_2)_2 + 3H_2O = 378.0$. [SUGAR OF LEAD.]

Preparation.—This important salt is made by adding lead oxide to acetic acid and gently heating the mixture until combination takes place.

$$\underset{\text{Lead Oxide.}}{PbO} + \underset{\text{Acetic Acid.}}{2HC_2H_3O_2} = \underset{\text{Lead Acetate.}}{Pb(C_2H_3O_2)_2} + \underset{\text{Water.}}{H_2O}.$$

The commercial salt is unfit for pharmaceutical uses; it is not expected to be pure, and usually contains both carbonate and oxide. The official salt is thus described:

Plumbi Acetas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
Colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, or in granular crystals, efflorescent and attracting carbon dioxide on exposure to air.	Faintly acetous odor; sweetish, astringent, afterwards metallic taste; faintly acid reaction.	At 15° C. (59° F.), 2.3 parts. Boiling, 0.5 part.	At 15° C. (59° F.), 21 parts. Boiling, 1 part.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated to 40° C. (104° F.), the salt loses its water of crystallization (14.25 per cent.). It fuses at 200° C. (392° F.) with the loss of acetic acid, and when strongly heated it is completely decomposed, with the evolution of carbon dioxide and acetone, leaving a residue of finely divided metallic lead mixed with oxide and carbonate. On heating the salt with sulphuric acid, vapors of acetic acid are evolved. The aqueous solution of the salt has a slightly acid reaction, and yields a black precipitate with hydrogen sulphide T.S., a yellow one with potassium iodide T.S., and a white one with diluted sulphuric acid.	Carbonate.	A 10-per-cent. solution of the salt, prepared with water which has recently been boiled, should be clear, or only slightly opalescent,
	Iron or Copper.	And should yield, with potassium ferrocyanide T.S., a pure white precipitate.
	Zinc or Iron.	If to the aqueous solution hydrochloric acid be added until no further precipitate is produced, and the remainder of the lead removed from the filtrate by hydrogen sulphide, a portion of the new filtrate should not be affected by the addition of a slight excess of ammonia water.
	Salts of the Alkalies or of Zinc.	If another portion of the last filtrate be evaporated to dryness, it should leave no residue.

Uses.—Lead acetate is a valuable astringent and sedative: it is used both internally and externally. The dose is from one to three grains (0.06 to 0.18 Gm.). Its solution in water is turbid, due to the formation of a trace of carbonate through the carbonic acid present in the water: this precipitate may be dissolved by the addition of a little acetic acid.

LIQUOR PLUMBI SUBACETATIS. *U.S.* **Solution of Lead Subacetate.**

An aqueous liquid, containing in solution about 25 per cent. of Lead Subacetate [approximately $Pb_2O(C_2H_3O_2)_2 = 546.48$].

	Metric.	Old form.
Lead Acetate	170 Gm.	8 oz. av. 168 gr.
Lead Oxide	100 Gm.	2 oz. av.
Distilled Water, a sufficient quantity,		
To make	1000 Gm.	1 pint.

Dissolve the Lead Acetate in 800 Gm. [old form 13 fl. oz.] of boiling Distilled Water, in a glass or porcelain vessel. Then add the Lead Oxide, previously passed through a fine sieve, and boil for half an hour, occasionally adding hot Distilled Water to make up the loss by evaporation. Remove the heat, allow the liquid to cool, and add enough Distilled Water, previously boiled and cooled, to make the product weigh 1000 Gm. [old form 1 pint]. Finally, filter the liquid in a closely-covered funnel.

Keep the product in well-stoppered bottles.

The object of this process is to furnish a concentrated solution of a lead compound containing a small proportion of acetic acid. The "subacetate" is not a definite salt, but as found in the official solution it is a mixture of oxyacetates, produced by boiling the normal acetate in water in contact with the oxide.

$$\underset{\text{Lead Oxide.}}{3PbO} + \underset{\text{Lead Acetate.}}{3(Pb2C_2H_3O_2)} = \underset{\text{Lead Oxyacetates.}}{Pb_3O(C_2H_3O_2)_4 + Pb_3O_2(C_2H_3O_2)_2}.$$

Liquor Plumbi Subacetatis. *U. S.*	Quantitative Test.
A clear, colorless liquid, odorless, of a sweetish, astringent taste, and an alkaline reaction. On exposure to the air it absorbs carbon dioxide, which causes the formation of a white precipitate. Sp. gr. about 1.195 at 15° C. (59° F.). When added to a solution of acacia, it produces a dense white precipitate (distinction from an aqueous solution of *normal lead acetate*). In other respects it possesses the reactions given under Lead Acetate (see Plumbi Acetas).	If 13.67 Gm. of the Solution be diluted with 50 C.c. of water, there will be required for complete precipitation of the lead about 25 C.c. of normal sulphuric acid (each C.c. corresponding to 1 per cent. of Lead Subacetate), methyl-orange being used as indicator.

Uses.—This solution, which is frequently termed *Goulard's Extract*, is sedative and astringent: it is employed externally as an application to inflamed surfaces.

LIQUOR PLUMBI SUBACETATIS DILUTUS. *U. S.* Diluted Solution of Lead Subacetate.

[Lead Water.]

	Metric.	Old form.
Solution of Lead Subacetate	30 C.c.	460 minims.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	2 pints.

Mix the Solution of Lead Subacetate with enough Distilled Water, previously boiled and cooled, to make the product measure 1000 C.c. [old form 2 pints].

Keep the Solution in well-stoppered bottles.

This solution is opalescent, through the formation of a trace of carbonate, if the distilled water used has not been recently boiled and cooled, the object of which is to deprive the water of carbonic acid gas. The addition of a few drops of acetic acid clears the solution by dissolving the precipitate; but, as many serious errors have occurred through the internal use by patients of *lead* water in mistake for *lime* water, it is a good practice to dispense lead water in a slightly opalescent condition and lime water always as a transparent liquid, and, as an additional safeguard, to use blue poison bottles for the lead water.

Uses.—Lead water is used as a soothing application to inflamed surfaces.

CERATUM PLUMBI SUBACETATIS. *U. S.* Cerate of Lead Subacetate.

[Goulard's Cerate.]

This cerate is made by mixing 20 Gm. of solution of lead subacetate with 80 Gm. of camphor cerate. It possesses the sedative and astringent properties of the lead solution. It may be prevented from assuming a yellow color by the addition of a trace of acetic acid (see Part V.).

PLUMBI CARBONAS. *U. S.* Lead Carbonate.

$(PbCO_3)_2Pb(OH)_2 = 772.82.$

[White Lead.]

Lead carbonate should be kept in well-closed vessels.

Preparation.—This compound of lead may be made by mixing solutions of lead nitrate and sodium carbonate. It is manufactured

on an immense scale for use in the arts by exposing lead to the action of the air, acetic acid, and carbon dioxide, and by other methods.

Plumbi Carbonas. *U.S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, white, opaque powder or pulverulent mass, permanent in the air. When strongly heated, the salt turns yellow, without charring, and, if heated in contact with charcoal, is reduced to metallic lead.	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in acetic or diluted nitric acid, with effervescence.

Tests for Identity.	Impurities.	Tests for Impurities.
This solution yields a black precipitate with hydrogen sulphide T.S., a yellow one with potassium iodide T.S., and a white one with diluted sulphuric acid.	Zinc, Alkalies, or Alkaline Earths.	On completely precipitating the solution of the salt with hydrogen sulphide, the filtrate should not leave more than a trifling residue on evaporation.
If 1 Gm. of the salt be strongly ignited, in a porcelain crucible, it should leave a residue of lead oxide weighing not less than 0.85 Gm.	Insolubie Foreign Salts.	If 2 Gm. of the salt be dissolved in a mixture of 2 C.c. of nitric acid and 10 C.c. of water, it should not leave more than 0.2 Gm. of residue.

Uses.—Lead carbonate is employed externally in the form of an ointment, and is popularly used as a cosmetic. Its use is dangerous, however, owing to the risk from absorption. It was formerly used in solution of gutta-percha to clarify it, by aiding in carrying down mechanical impurities by its weight. When ground in oil this salt of lead is largely used as a paint; it is also employed occasionally in this form as an application to inflamed surfaces.

It is rarely administered internally.

UNGUENTUM PLUMBI CARBONATIS. *U.S.* Ointment of Lead Carbonate.

This ointment is made by rubbing 10 Gm. of lead carbonate with 90 Gm. of benzoinated lard. It is used as a soothing application to inflamed surfaces.

PLUMBI IODIDUM. *U.S.* Lead Iodide.

PbI_2; 459.46.

Preparation.—This Iodide may be made by the British process:

Take of Nitrate of Lead, Iodide of Potassium, each, 4 oz. av.; Distilled Water a sufficiency. Dissolve the Nitrate of Lead, by the aid of heat, in a pint and a half, and the Iodide of Potassium in half a pint, of the Water, and mix the solutions. Collect the precipitate on a filter, wash it with Distilled Water, and dry it at a gentle heat.

This is an instance of double decomposition, lead iodide and potassium nitrate being formed. The nitrate is preferred to the acetate,

because lead iodide is more soluble in solution of potassium acetate than in that of potassium nitrate.

$$\underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Lead Nitrate.}}{Pb2NO_3} = \underset{\text{Lead Iodide.}}{PbI_2} + \underset{\text{Potassium Nitrate.}}{2KNO_3}.$$

Plumbi Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A heavy, bright yellow powder, permanent in the air. When moderately heated, the salt fuses to a thick reddish-brown liquid, which congeals, on cooling, to a yellow, crystalline mass. When strongly heated, the salt fuses, and at a higher temperature it is decomposed, emitting violet vapors of iodine, and leaving a citron-yellow residue of lead oxyiodide.	Odorless; tasteless; neutral reaction.	At 15° C. (59° F.), 2000 parts. Boiling, 200 parts. Separating from the latter solution in brilliant, golden-yellow spangles or crystalline laminæ.	Very slightly soluble.	Soluble without color in solutions of the fixed alkalies, and in concentrated solutions of the acetates of the alkalies, potassium iodide, sodium hyposulphite, and in a hot solution of ammonium chloride.

Impurities.	Tests for Impurities.
Chromate and other Insoluble Foreign Salts.	If 1 Gm. of the salt be triturated with 2 Gm. of ammonium chloride and 2 C.c. of water, a nearly white mixture will result. If this be transferred to a test-tube, and heated in a water-bath for a few minutes, a clear and almost colorless solution should be formed. On cooling this solution, a solid mass of nearly colorless, fine silky crystals is produced, and on adding water or diluted sulphuric acid to this mass, yellow lead iodide will be separated.
Nitrate.	If 1 Gm. of the salt be boiled for a few minutes with 20 C.c. of water, the mixture then cooled and filtered, the lead removed from the filtrate by hydrogen sulphide, and the new filtrate somewhat concentrated by evaporation, a portion of this liquid, when mixed with a little sulphuric acid and tinted with a drop of indigo T.S., should not become decolorized on heating.
Acetate.	If another portion of the liquid be carefully neutralized with ammonia water, it should not become colored red by a drop of ferric chloride T.S.
Soluble Foreign Salts.	If the remainder of the filtrate be evaporated to dryness, it should leave no residue.

Uses.—Lead iodide is used principally to form an official ointment. It may be given internally in doses of one to three grains (0.06 to 0.18 Gm.).

UNGUENTUM PLUMBI IODIDI. *U. S.* Ointment of Lead Iodide.

This ointment is made by rubbing 10 Gm. of lead iodide with 90 Gm. of benzoinated lard. It is used as an application to tumors and indolent swellings.

PLUMBI NITRAS. *U. S.* Lead Nitrate.

$Pb(NO_3)_2$; 330.18.

Preparation.—This salt may be easily made by adding lead oxide to equal parts of nitric acid and water, heating the mixture until the solution is effected, and, after filtering, evaporating the solution of lead nitrate and crystallizing.

Plumbi Nitras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent, octohedral crystals, when obtained by the spontaneous evaporation of cold solutions, or white, nearly opaque crystals, when formed by the cooling of hot solutions, permanent in the air. When strongly heated, the salt decrepitates, emits nitrous vapors, and finally leaves a residue of lead oxide.	Odorless; sweetish, astringent, afterwards metallic taste; acid reaction.	At 15° C. (59° F.), 2 parts. Boiling, 0.75 part.	Almost insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
The aqueous solution of the salt yields a black precipitate with hydrogen sulphide T.S., a white one with diluted sulphuric acid, and a yellow one with potassium iodide T.S.	Iron or Copper.	A 10-per-cent. aqueous solution of the salt should give, with potassium ferrocyanide T.S., a pure white precipitate.
	Zinc or Iron.	If hydrochloric acid be added to the aqueous solution until no further precipitate is produced, and the remainder of the lead be removed from the filtrate by hydrogen sulphide, a portion of the new filtrate should not be affected by the addition of a slight excess of ammonia water.
	Salts of the Alkalies or of Zinc.	If another portion be evaporated to dryness, it should leave no residue.

Uses.—Lead nitrate is used in solution principally as an external application to excoriated surfaces.

PLUMBI OXIDUM. *U. S.* Lead Oxide.

PbO; 222.36. [Litharge.]

Preparation.—Litharge is lead oxide which has been rendered semi-crystalline by incomplete fusion. Almost all the litharge of commerce is obtained as a secondary product in the process for extracting silver from argentiferous galenas. After extracting the lead from the ore, the alloy is calcined in the open air; whereby the lead becomes oxidized, and by fusion passes into the state of litharge, while the silver remains unchanged.

Red lead is a higher oxide, Pb_3O_4; 683.04, and is made by sprinkling hot litharge with water, powdering and drying it, and then heating it out of contact with air. Litharge is officially described as follows:

Plumbi Oxidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, yellowish or reddish-yellow powder, or minute scales. On exposure to the air it slowly absorbs moisture and carbon dioxide. When heated, the Oxide assumes a brownish-red color, becoming yellow again on cooling. It fuses at a red heat. When heated in contact with charcoal, it is reduced to metallic lead.	Odorless; tasteless; faintly alkaline reaction.	Almost insoluble.	Insoluble.	Soluble in acetic and diluted nitric acids, and in warm solutions of the fixed alkalies.

Tests for Identity.	Impurities.	Tests for Impurities.
The diluted and filtered solution of the salt yields a black precipitate with hydrogen sulphide T.S., a white one with diluted sulphuric acid, soluble in a strong solution of sodium hydrate, and a yellow one with potassium iodide T.S.	Carbonate.	Lead Oxide should be soluble in diluted nitric acid with but little effervescence,
	Silicate, Barium Sulphate, etc.	And without the development of the odor of nitrous acid, leaving not more than a trifling residue.
	Copper.	If from the solution in diluted nitric acid the lead be precipitated by sulphuric acid, the filtrate, after the addition of an excess of ammonia water, should not assume more than a slight bluish tint,
	Iron.	Nor yield more than traces of a reddish-yellow precipitate.
	More than 1.5 per cent. of Insoluble Impurities.	If 5 Gm. of the Oxide contained in a small flask be shaken with 5 C.c. of water, then 20 C.c. of acetic acid added, and the mixture boiled for a few minutes and filtered, the insoluble residue, when well washed and dried, should not weigh more than 0.075 Gm.
	Carbonate and Moisture.	When strongly heated, in a porcelain crucible, the Oxide should not lose more than 2 per cent. of its weight.

EMPLASTRUM PLUMBI. *U.S.* Lead Plaster.

[Diachylon Plaster.]

This compound of lead is made by boiling lead oxide with olive oil and water, whereby the lead enters into combination with the fatty acids of the oil; it is a lead oleo-palmitate. (See Glycerinum.) It is used as the basis of many plasters.

UNGUENTUM DIACHYLON. *U.S.* Diachylon Ointment.

This ointment is simply lead plaster diluted with olive oil to the consistence of an ointment and slightly perfumed with oil of lavender. (See Unguenta.) It is used externally in several skin diseases.

Copper. Cu; 63.18.

Copper is found naturally in its metallic condition, as a sulphide or oxide, and as a sulphate, carbonate, phosphate, or arsenate. It is a brilliant metal, of a red color, having a sp. gr. of 8.92 to 8.95. It forms two oxides: 1. Red cuprous oxide, Cu_2O, and, 2. Black cupric oxide, CuO.

Tests for Compounds of Copper.

1. Hydrogen sulphide or ammonium sulphide produces a black precipitate of cupric sulphide.
2. Ammonia water produces in concentrated solutions of copper salts a pale blue precipitate of cupric hydroxide, in dilute solutions a deep blue coloration.
3. Potassium ferrocyanide produces a reddish-brown precipitate of cupric ferrocyanide.
4. A bright surface of metallic iron or zinc immersed in an acidulated solution of a copper salt is coated with metallic copper.
5. Copper salts color the flame of an alcohol lamp or Bunsen burner green.

Official Preparation of Copper.

Official Name.	Preparation.
Cupri Sulphas . . .	By treating copper with diluted sulphuric acid, evaporating the solution, and crystallizing.

Unofficial Preparations of Copper.

Cupri Acetas. Copper Acetate.	By treating copper with acetic acid and purifying the product by crystallization.
Cupri Arsenas, $Cu_3As_2O_8$. Copper Arsenate.	By adding a solution of copper sulphate to a solution of disodic arsenate, and collecting and drying the precipitate.
Cupri Bromidum, $CuBr_2$. Copper Bromide.	By evaporating a solution of cupric oxide in aqueous hydrobromic acid, and fusing the residue at a gentle heat.
Cupri Citras. Copper Citrate.	By heating a solution of cupric acetate with citric acid and setting aside to crystallize.
Cupri Nitras, $Cu(NO_3)_2$. Copper Nitrate.	By dissolving metallic copper in nitric acid and concentrating the solution, then crystallizing.
Cupri Oxidum, CuO. Cupric Oxide.	By continued ignition of copper in contact with air.
Cupri Subacetas, $Cu(HO)_2.Cu(C_2H_3O_2)_2$. Verdigris.	Made by acting on sheets of copper with acetic acid.
Cupri Tartras. Copper Tartrate.	By adding a solution of neutral potassium tartrate to a solution of cupric sulphate and collecting the precipitate.

CUPRI SULPHAS. *U. S.* Copper Sulphate.

$CuSO_4 + 5H_2O = 248.8.$ [CUPRIC SULPHATE.]

Preparation.—This salt is economically made by acting on scrap copper with diluted sulphuric acid, heating, evaporating the solution, and crystallizing.

Cupri Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Large, translucent, deep blue, triclinic crystals, efflorescent in dry air. When carefully and continuously heated to 30° C. (86° F.), the salt loses two of its five molecules of water (14.43 per cent.), and is converted into a pale blue, amorphous powder. Two more molecules of water are lost at 100° C. (212° F.), while the fifth is retained until 200° C. (392° F.) is reached, when a white anhydrous powder remains (63.9 per cent. of the original weight). At a still higher temperature sulphur dioxide and oxygen are given off, and a residue of black cupric oxide is left. If a drop of the solution be placed on a bright piece of iron, it will produce a red stain of metallic copper.	Odorless; nauseous, metallic taste; acid reaction.	At 15° C. (59° F.), 2.6 parts. Boiling, 0.5 part.	Almost insoluble.

Tests for Identity.	Impurities.	Tests for Impurities.
Barium chloride T.S. yields a white precipitate, insoluble in hydrochloric acid. With potassium ferrocyanide T.S. the solution yields a deep reddish-brown precipitate.	Iron, Aluminum, and Alkaline Earths.	If a little hydrochloric and some diluted sulphuric acid be added to 10 C.c. of the aqueous solution of the salt, and this be treated with hydrogen sulphide gas until the copper is completely precipitated, the filtrate should not leave more than a trace of residue on evaporation.
	Iron, Aluminum.	If ammonia water be added to the solution, drop by drop, a pale blue precipitate of cupric hydrate is formed, which redissolves in an excess of ammonia water, forming a deep azure-blue solution, leaving no trace of residue undissolved.
	Arsenic, Lead, Zinc, etc.	If the aqueous solution (1 in 20) be heated to boiling with an excess of sodium hydrate T.S. until all of the copper has been converted into black cupric oxide, it will yield a filtrate which, after acidulation with acetic acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S.

Uses.—Copper sulphate, called commercially *blue vitriol,* is used internally as an emetic in doses of five grains (0.3 Gm.); as an astringent or tonic, from one-quarter to one-half grain (0.016 to 0.03 Gm.) is given. It is used as an injection in gonorrhœa and other diseases, and also as a stimulant wash, and in substance as an escharotic.

Silver. Ag; 107.66.

Silver is found in the metallic state, but usually as a sulphide, and associated with lead sulphide, or *galena.*

Silver is a brilliant white metal, very malleable and ductile, having a sp. gr. of 10.4 to 10.5. It forms but one oxide, Ag_2O.

Tests for Silver Salts.

1. Hydrochloric acid or any soluble chloride produces with a soluble salt of silver a characteristic, curdy, white precipitate of silver chloride, which is insoluble in hot nitric acid, but soluble in ammonia water.
2. Hydrogen sulphide or ammonium sulphide produces a black precipitate of silver sulphide.
3. Caustic alkalies produce a brown precipitate of silver oxide.

Official Preparations of Silver.

Official Name.	Preparation.
Argenti Cyanidum	By passing hydrocyanic acid gas into solution of silver nitrate.
Argenti Iodidum	By double decomposition between potassium iodide and silver nitrate.
Argenti Nitras	By treating metallic silver with nitric acid, evaporating the solution, and crystallizing.
Argenti Nitras Dilutus	By fusing equal parts of silver nitrate and potassium nitrate.
Argenti Nitras Fusus	By fusing and moulding silver nitrate.
Argenti Oxidum	By precipitating solution of silver nitrate with solution of potassa.

Unofficial Preparations of Silver.

Argenti Acetas, $AgC_2H_3O_2$. Silver Acetate.	By adding a solution of silver nitrate to a solution of sodium acetate, then collecting and drying the precipitate.
Argenti Bromidum, AgBr. Silver Bromide.	By adding to a solution of silver nitrate a solution of potassium bromide, then collecting and drying the precipitate.
Argenti Chloridum, AgCl. Silver Chloride.	By adding to a solution of silver nitrate hydrochloric acid as long as a precipitate is produced, then collecting and drying the precipitate.
Argenti Chromas, Ag_2CrO_4. Silver Chromate.	By adding a solution of neutral potassium chromate to a solution of silver nitrate, then collecting and drying the precipitate.
Argenti Lactas, $AgC_3H_5O_3.H_2O$. Silver Lactate.	By boiling silver carbonate with lactic acid, and collecting and drying the precipitate.
Argenti Oxalas, $Ag_2C_2O_4$. Silver Oxalate.	By adding a solution of oxalic acid to a solution of silver nitrate, and collecting and drying the precipitate.
Argenti Phosphas, Ag_3PO_4. Silver Phosphate.	By adding a solution of silver nitrate to a solution of sodium phosphate, and collecting and drying the precipitate.
Argenti Sulphas, Ag_2SO_4. Silver Sulphate.	By adding a solution of silver nitrate to a solution of sodium sulphate, and collecting and drying the precipitate.

ARGENTI CYANIDUM. U. S. Silver Cyanide.

$AgCN$; 133.64.

Preparation.—Silver cyanide is easily prepared by passing hydrocyanic acid gas into a solution of silver nitrate, or by mixing solutions of potassium cyanide and silver nitrate.

$$\underset{\text{Silver Nitrate.}}{AgNO_3} + \underset{\text{Potassium Cyanide.}}{KCN} = \underset{\text{Silver Cyanide.}}{AgCN} + \underset{\text{Potassium Nitrate.}}{KNO_3}.$$

Argenti Cyanidum. U. S.	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
A white powder, permanent in dry air, but gradually turning brown by exposure to light.	Odorless; tasteless.	Insoluble.	Insoluble.	Insoluble in cold but soluble in boiling nitric acid, with evolution of hydrocyanic acid; soluble in ammonia water and in solution of sodium hyposulphite.

Test for Identity.
When heated, the salt fuses, gives off cyanogen gas, and, on ignition, leaves a residue of metallic silver amounting to 80.56 per cent. of its original weight.

Silver cyanide should be kept in dark amber-colored vials, protected from light.

Uses.—This salt was made official to use in the extemporaneous preparation of hydrocyanic acid. (See Acidum Hydrocyanicum Dilutum.)

ARGENTI IODIDUM. U. S. Silver Iodide.

AgI; 234.19.

Preparation.—This iodide may be made by double decomposition between potassium iodide and silver nitrate.

$$\underset{\text{Potassium Iodide.}}{KI} + \underset{\text{Silver Nitrate.}}{AgNO_3} = \underset{\text{Silver Iodide.}}{AgI} + \underset{\text{Potassium Nitrate.}}{KNO_3}.$$

Silver iodide should be kept in dark amber-colored vials, protected from light.

Argenti Iodidum. U. S.	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
A heavy, amorphous, light yellowish powder, unaltered by light, if pure, but generally becoming greenish-yellow. When heated to about 400° C. (752° F.), it melts to a dark red liquid, which, on cooling, congeals to a soft, yellow, slightly transparent mass.	Odorless; tasteless.	Insoluble.	Insoluble.	Insoluble in diluted acids or in solution of ammonium carbonate; soluble in about 2500 parts of stronger ammonia water.

TESTS FOR IDENTITY.	IMPURITIES.	TESTS FOR IMPURITIES.
When mixed with ammonia water, it turns white, but regains its yellowish color by washing with water. It is also dissolved by an aqueous solution of potassium cyanide, and by a concentrated solution of potassium iodide, and the resulting solutions yield a black precipitate with hydrogen sulphide T.S. or ammonium sulphide T.S. If a small quantity of chlorine water be agitated with an excess of the salt, the filtrate acquires a dark blue color on the addition of starch T.S.	Chloride.	If 0.5 Gm. of the salt be digested for five minutes with 10 C.c. of a cold 15-per-cent. solution of ammonium carbonate, the filtrate, when supersaturated with nitric acid, should not be rendered more than faintly opalescent.
	Bromide.	On digesting a portion of the salt—which has been found to be free from chloride, or from which the latter has been completely removed by repeated digestion with ammonium carbonate—for five minutes with 10 C.c. of ammonia water, and supersaturating the filtrate with nitric acid, only a slight opalescence, but no yellowish-white precipitate, should be produced.

Uses.—Silver iodide has been used in syphilis, in doses of one-half grain to two grains (0.03 to 0.13 Gm.).

ARGENTI NITRAS. *U. S.* Silver Nitrate.

$AgNO_3$; 169.55.

Preparation.—This valuable salt may be made by the former official process:

Take of Silver, in small pieces, 2 oz. troy; Nitric Acid 2½ oz. troy; Distilled Water a sufficient quantity. Mix the Acid with a fluidounce of Distilled Water in a porcelain capsule, add the Silver to the mixture, cover it with an inverted glass funnel, resting within the edge of the capsule, and apply a gentle heat until the metal is dissolved, and red vapors cease to be produced; then remove the funnel, and, increasing the heat, evaporate the solution to dryness. Melt the dry mass, and continue the heat, stirring constantly with a glass rod, until free nitric acid is entirely dissipated. Dissolve the melted salt, when cold, in six fluidounces of Distilled Water, allow the insoluble matter to subside, and decant the clear solution. Mix the residue with a fluidounce of Distilled Water, filter through paper, and, having added the filtrate to the decanted solution, evaporate the liquid until a pellicle begins to form, and set it aside in a warm place to crystallize. Lastly, drain the crystals in a glass funnel until dry, and preserve them in a well-stopped bottle. By evaporating the mother-water, more crystals may be obtained.

The silver employed is usually coin, and this always contains copper: hence copper nitrate is present, which is known by the bluish color of the solution. By evaporating the solution and fusing the residue the copper salt is decomposed and the insoluble copper oxide produced; by solution and filtration this is separated, and the purified solution of silver nitrate is evaporated and crystallized.

$$\underset{\text{Silver.}}{Ag_3} + \underset{\text{Nitric Acid.}}{4HNO_3} = \underset{\text{Silver Nitrate.}}{3AgNO_3} + \underset{\text{Nitrogen Monoxide.}}{NO} + \underset{\text{Water.}}{2H_2O}.$$

Argenti Nitras. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.
Colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in presence of organic matter.	Odorless; bitter, caustic, and strongly metallic taste; neutral reaction.	At 15° C. (59° F.), 0.6 part. Boiling, 0.1 part.	Cold, 26 parts. Boiling, 5 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated to about 200° C. (392° F.), the salt fuses to a faintly yellow liquid, which, on cooling, congeals to a purely white, crystalline mass. At a higher temperature the salt is gradually decomposed, with evolution of nitrous vapors. An aqueous solution of the salt yields, with hydrochloric acid, a white precipitate soluble in ammonia.	Foreign Salts.	If all the silver be precipitated with hydrochloric acid, and the filtrate be evaporated to dryness, no fixed residue should be left.
0.34 (0.3391) Gm. of Silver Nitrate, dissolved in 10 C.c. of water, should require, for complete precipitation, 20 C.c. of decinormal sodium chloride V.S. (corresponding to 100 per cent. of the pure salt).	Lead.	If 5 C.c. of a 10-per-cent. aqueous solution of the salt be mixed with 20 C.c. of diluted sulphuric acid, and heated to boiling, no turbidity should be perceptible.

Uses.—Silver nitrate is used externally as a caustic and escharotic; internally, it is given in gastritis and diarrhœa, in doses of one-fourth to one-half grain (0.016 to 0.032 Gm.).

ARGENTI NITRAS DILUTUS. *U. S.* Diluted Silver Nitrate.
[Mitigated Caustic.]

	Metric.	Old form.
Silver Nitrate	30 Gm.	1 oz. av.
Potassium Nitrate	60 Gm.	2 oz. av.

Melt the salts together in a porcelain crucible, at as low a temperature as possible, stirring the melted mass well until it flows smoothly. Then cast it into suitable moulds. Keep the product in dark amber-colored vials.

This preparation contains now 33.3 per cent. of silver nitrate, instead of 50 per cent. as in the U. S. P. 1880.

Uses.—The object of this preparation is to provide a fused silver nitrate, which may often be useful where the undiluted caustic might prove too severe in its action.

Argenti Nitras Dilutus. *U. S.*	Tests.
A white, hard solid, generally in form of pencils or cones of a finely granular fracture, becoming gray or grayish-black on exposure to light in presence of organic matter. Odorless, having a caustic, metallic taste and a neutral reaction. Each of its constituents retains the solubility in water and in alcohol mentioned respectively under *Argenti Nitras* and *Potassii Nitras.*	If 1 Gm. of Diluted Silver Nitrate, dissolved in 10 C.c. of water, be mixed with 20 C.c. of decinormal sodium chloride V.S., and a few drops of potassium chromate T.S., not more than 0.5 C.c. of decinormal silver nitrate V.S. should be required to impart to the liquid a permanent red color (corresponding to at least 33 per cent. of pure silver nitrate). An aqueous solution of Diluted Silver Nitrate yields, with a slight excess of hydrochloric acid, a white precipitate, which is readily soluble in ammonia water. The filtrate from this precipitate, when evaporated to dryness, leaves a white residue which is completely soluble in water, and which yields a yellow, crystalline precipitate with platinic chloride T.S., and a white, crystalline precipitate with sodium bitartrate T.S.

Impurities.	Tests for Impurities.
Copper.	If to an aqueous solution of Diluted Silver Nitrate a slight excess of ammonia water be added, it should not assume a blue color.
Lead and Bismuth.	If to an aqueous solution of Diluted Silver Nitrate a slight excess of ammonia water be added, it should not show any turbidity.

Uses.—This preparation is used only externally. It is similar in its action to the moulded nitrate, but less energetic.

ARGENTI NITRAS FUSUS. *U.S.* Moulded Silver Nitrate.

[LUNAR CAUSTIC.]

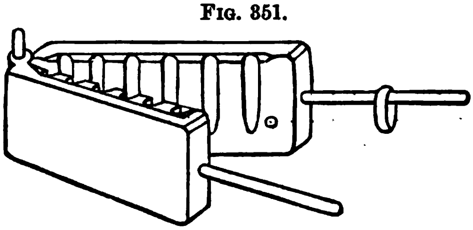
	Metric.	Old form.
Silver Nitrate	100 Gm.	1 oz. av.
Hydrochloric Acid	4 Gm.	16 minims.

To the Silver Nitrate, contained in a porcelain capsule, add the Hydrochloric Acid, and melt the mixture at as low a temperature as possible. Stir well, and pour the melted mass into suitable moulds.

Keep the product in dark amber-colored vials, protected from light.

When pure fused silver nitrate is cooled, the mass is very brittle, but the addition of hydrochloric acid produces sufficient silver chloride to toughen it, so that the cast cones or sticks will not break so easily. In order to keep the sticks from becoming discolored during the casting process, it is advisable to add a little diluted nitric acid (1 in 5) occasionally to the melted nitrate, and carefully prevent the mass from becoming overheated. Fig. 351 illustrates the silver moulds used in moulding the cones.

FIG. 351.



Caustic point mould.

Argenti Nitras Fusus. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvent.
A white, hard solid, generally in form of pencils or cones of a fibrous fracture, becoming gray or grayish-black on exposure to light in presence of organic matter.	Odorless; bitter, caustic, and strongly metallic taste; neutral reaction.	At 15° C. (59° F.), Soluble, with the exception of about 5 per cent. of silver chloride, in 0.6 part. Boiling, Soluble, with the exception of about 5 per cent. of silver chloride, in 0.1 part.	Cold, Soluble, with the exception of about 5 per cent. of silver chloride, in 26 parts. Boiling, Soluble, with the exception of about 5 per cent. of silver chloride, in 5 parts.	Whatever is left undissolved by water is completely soluble in ammonia water.

Test for Identity and Quantitative Test.
A clear, aqueous solution of the salt, decanted from the insoluble portion, should be neutral to litmus paper, and it should respond to the tests of identity and purity mentioned under Argenti Nitras.
If 0.34 Gm. of moulded Silver Nitrate, dissolved as completely as possible in 10 C.c. of water, be mixed with 20 C.c. of decinormal sodium chloride V.S. and a few drops of potassium chromate T.S., not more than 1 C.c. of decinormal silver nitrate V.S. should be required to impart to the liquid a permanent red color (corresponding to 95 per cent. of pure silver nitrate).

Uses.—Moulded silver nitrate is used as an escharotic: a good caustic-holder may be made from a glass stirring-rod of the same diameter as the cone by joining it to the cone with a short length of rubber tubing. The cone may be protected from the action of the air by slipping over it another short length of rubber tubing, having a very short piece of glass rod in the other end as a stopper.

Death has resulted more than once through the careless use of silver nitrate in cauterizing the throat, the cone having slipped out of the holder and then been swallowed by the patient.

ARGENTI OXIDUM. *U. S.* Silver Oxide.

Ag_2O; 231.28.

Preparation.—This salt may be made by a former official process: Take of Nitrate of Silver 4 oz. troy; Distilled Water half a pint; Solution of Potassa 1½ pints, or a sufficient quantity. Dissolve the Nitrate of Silver in the Water, and to the solution add Solution of Potassa so long as it produces a precipitate. Wash this repeatedly with water until the washings are nearly tasteless. Lastly, dry the precipitate and keep it in a well-stopped bottle, protected from the light.

$$\underset{\text{Silver Nitrate.}}{2AgNO_3} + \underset{\text{Potassium Hydrate.}}{2KHO} = \underset{\text{Silver Oxide.}}{Ag_2O} + \underset{\text{Potassium Nitrate.}}{2KNO_3} + \underset{\text{Water.}}{H_2O.}$$

Argenti Oxidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
A heavy, dark brownish-black powder, liable to reduction by exposure to light. When heated to about 250° to 300° C. (482° to 572° F.), it loses oxygen, and metallic silver is left behind.	Odorless; metallic taste; imparts an alkaline reaction to water.	Very slightly soluble.	Insoluble.

Tests.	Impurity.	Test for Impurity.
The solution of the Oxide should be colorless, and should respond to the reactions and tests mentioned under *Silver Nitrate* (see *Argenti Nitras*). If 0.5 Gm. of the Oxide be ignited in a porcelain crucible, it should yield 0.465 Gm. (or 93.1 per cent.) of metallic silver.	Carbonate.	On adding Silver Oxide to nitric acid, no effervescence should take place.

Uses.—Silver oxide is used as a substitute for silver nitrate, being much less caustic than the latter, and better suited for internal use, owing to the facility with which it parts with its oxygen. Silver oxide should not be triturated with readily oxidizable or combustible substances, and should not be brought in contact with ammonia. The dose is one grain (0.065 Gm.).

Gelatin capsules are well fitted for dispensing this compound. With most excipients decomposition ensues, and the pills have been known to explode with some violence.

Mercury. Hg; 199.8.

Mercury, or quicksilver, is found most abundantly as sulphide, or *cinnabar:* the principal mines are in Spain and California. It is a brilliant, silver-white metal, liquid above —40° C. (—40° F.), and having the sp. gr. 13.5584. Mercury forms two series of compounds,—*mercurous*, containing the group (Hg_2), and *mercuric*, containing the single atom Hg. It is used more largely in medicine in the metallic state than any other element.

Tests for Compounds of Mercury.

1. Ammonium sulphide or hydrogen sulphide, in excess, produces a black precipitate (sulphide) in solutions of salts of mercury.
2. Potassium iodide produces with mercurous salts a green precipitate of mercurous iodide, or with mercuric salts a red precipitate of mercuric iodide, soluble in excess.
3. With hydrochloric acid or soluble chlorides a white precipitate of mercurous chloride is produced with mercurous salts, whilst with mercuric salts no precipitation occurs.
4. A plate of copper or a solution of stannous chloride, in excess, precipitates the metal from its soluble combinations.

Official Preparations of Mercury.

Official Name.	Preparation.
	Preparations of the Metal.
Hydrargyrum cum Creta	By extinguishing 38 Gm. of mercury with 10 Gm. of clarified honey and 57 Gm. of prepared chalk.
Emplastrum Hydrargyri	By extinguishing 300 Gm. of mercury with 12 Gm. of oleate of mercury, and incorporating with sufficient melted lead plaster to make 1000 Gm.
Emplastrum Ammoniaci cum Hydrargyro	By extinguishing 18 per cent. of mercury with oleate of mercury, ammoniac, diluted acetic acid, and lead plaster.
Massa Hydrargyri	By extinguishing 33 per cent. of mercury with honey of rose and glycerin, and then adding powdered glycyrrhiza and powdered althæa.
Unguentum Hydrargyri	By extinguishing 500 Gm. of mercury with 20 Gm. of oleate of mercury, then adding sufficient melted lard and suet to make 1000 Gm.

Official Preparations of Mercury.—*Continued.*

Official Name.	Preparation.
Salts of Mercury and their Preparations.	
Hydrargyrum Ammoniatum	By precipitating solution of mercuric chloride with ammonia water.
Unguentum Hydrargyri Ammoniati .	By incorporating 10 Gm. of ammoniated mercury with 90 Gm. of benzoinated lard.
Hydrargyri Chloridum Corrosivum .	By subliming mercuric sulphate with sodium chloride.
Hydrargyri Chloridum Mite	By subliming mercuric sulphate and mercury with sodium chloride.
Hydrargyri Cyanidum	By passing hydrocyanic acid into a vessel containing mercuric oxide with water.
Hydrargyri Iodidum Rubrum . . .	By double decomposition between mercuric chloride and potassium iodide.
Hydrargyri Iodidum Flavum . . .	By precipitating an acid solution of mercurous nitrate with potassium iodide.
Hydrargyri Oxidum Flavum	By precipitating solution of mercuric chloride with sodium hydrate.
Unguentum Hydrargyri Oxidi Flavi .	By incorporating 10 Gm. of yellow mercuric oxide with 90 Gm. of ointment.
Oleatum Hydrargyri	By dissolving 20 Gm. of yellow mercuric oxide in 80 Gm. of oleic acid.
Hydrargyri Oxidum Rubrum	By decomposing mercuric nitrate by heat.
Unguentum Hydrargyri Oxidi Rubri .	By incorporating 10 Gm. of red mercuric oxide with 5 Gm. of castor oil and 85 Gm. of ointment.
Hydrargyri Subsulphas Flavus . . .	By adding mercuric sulphate to boiling water.
Liquor Hydrargyri Nitratis	By dissolving 40 Gm. of red mercuric oxide in 45 Gm. of nitric acid and 15 Gm. of water.
Unguentum Hydrargyri Nitratis . .	By treating lard oil with nitric acid, and then incorporating solution of mercuric nitrate.

Unofficial Preparations of Mercury.

Hydrargyri Acetas. Mercuric Acetate.	By dissolving mercuric oxide in acetic acid, filtering, and concentrating to crystallize.
Hydrargyri Arsenas. Mercuric Arsenate.	By adding a solution of arsenic acid to a solution of mercuric nitrate, and collecting the precipitate.
Hydrargyri Bromidum, $HgBr_2$. Mercuric Bromide.	By dissolving mercuric oxide in hot aqueous hydrobromic acid, filtering and concentrating, then crystallizing.
Hydrargyri Carbonas, Hg_2CO_3. Mercurous Carbonate.	By precipitating a solution of mercurous nitrate with acid potassium carbonate, and collecting the precipitate.
Hydrargyri Chloras, $Hg(ClO_3)_2 + H_2O$. Mercuric Chlorate.	By dissolving mercuric oxide in warm chloric acid, filtering and concentrating, then crystallizing.
Hydrargyri Chromas, $HgCrO_4$. Mercuric Chromate.	By boiling equal parts of chromic acid and yellow mercuric oxide in water, and collecting the red crystals.
Hydrargyri Lactas, $(Hg_2)_2(C_3H_5O_3)_2.2H_2O$. Mercurous Lactate.	By mixing boiling solutions of sodium lactate and mercurous nitrate, and collecting the precipitate.
Hydrargyri Sulphidum Rubrum, HgS.	By fusing and subliming mercury and sulphur.
Hydrargyri Nitras, $Hg_2(NO_3)_2.2H_2O$. Mercurous Nitrate.	By mixing 4 p. mercury, 3 p. nitric acid, 1 p. water, and after twenty-four hours collecting the crystals.
Hydrargyri Sulphas, $HgSO_4$. Mercuric Sulphate.	By heating 10 oz. mercury with 6 fl. oz. sulphuric acid, in a porcelain vessel, and stirring constantly until a white salt is obtained.

HYDRARGYRUM. *U. S.* Mercury.

Hg; 199.8. [QUICKSILVER.]

Mercury for pharmaceutical uses should be pure. To separate mechanical impurities, moisture, or small quantities of oxide, mercury may be filtered by collecting it in a sound piece of chamois leather and

gathering the corners together, forcibly squeezing the particles through the pores of the leather. But distillation is preferable in most cases to purify the metal effectually, which may be accomplished by a process formerly official in the British Pharmacopœia, as follows:

Take of Mercury of Commerce 3 pounds [avoirdupois]; Hydrochloric Acid 3 fluidrachms; Distilled Water a sufficiency. Place the Commercial Mercury in a glass retort or iron bottle, and, applying heat, cause two pounds and a half of the metal to distil over into a flask employed as a receiver. Boil on this for five minutes the Hydrochloric Acid diluted with 9 fluidrachms of Distilled Water, and having, by repeated affusions of Distilled Water and decantations, removed every trace of acid, let the mercury be transferred to a porcelain capsule, and dried first by filtering paper, and finally on a water-bath.

Hydrargyrum. *U.S.*	Impurities.	Tests for Impurities.
A shining, silver-white metal, liquid at temperatures above —40° C. (—40° F.), odorless and tasteless, and insoluble in ordinary solvents, also in concentrated hydrochloric acid, and at common temperatures in sulphuric acid,—but it dissolves in the latter when boiled with it; soluble in nitric acid without residue. Sp. gr. 13.5584 at 15° C. (59° F.). At the common temperature it volatilizes very slowly, more rapidly as the temperature increases, and at 357.25° C. (675.05° F.) it boils, being finally volatilized without residue, yielding a colorless and very poisonous vapor.	Tin and other Metals.	When globules of Mercury are dropped upon white paper, they should roll about freely, retaining their globular form and leaving no streaks or traces.
	Moisture.	Mercury should be perfectly dry.
	Organic Impurities.	Mercury should present a bright surface.
	More than slight traces of Foreign Metals.	On boiling 5 Gm. of distilled water with 5 Gm. of Mercury and 4.5 Gm. of sodium hyposulphite in a test-tube for about one minute, the mercury should not lose its lustre, and should not acquire more than a slightly yellowish shade.

Uses.—When mercury is administered in a finely divided condition, as in blue mass, or in mercury with chalk, it exerts a peculiar action on the liver, which is termed alterative. This action is possessed by some of its salts.

MASSA HYDRARGYRI. *U.S.* Mass of Mercury.

[Pilulæ Hydrargyri. Blue Mass. Blue Pill.]

	Metric.	Old form.
Mercury	33 Gm.	5 oz. av. 122 gr.
Glycyrrhiza, in No. 60 powder	5 Gm.	350 gr.
Althæa, in No. 60 powder	25 Gm.	4 oz. av.
Glycerin	3 Gm.	8 fl. dr.
Honey of Rose	34 Gm.	4½ fl. oz.
To make	100 Gm.	16 oz. av.

Triturate the Mercury with the Honey of Rose and Glycerin until it is extinguished. Then gradually add the Glycyrrhiza and Althæa, and continue the trituration until globules of Mercury are no longer

visible under a lens magnifying at least ten diameters. (See tests under Hydrargyrum cum Creta.)

By using this formula the pharmacist is enabled to make blue mass extemporaneously with very little labor. The mass should not be *forcibly pressed*, or the globules of mercury will run together, and will grow larger instead of smaller.

Uses.—The object of this preparation is to furnish mercury in a finely divided condition. It is given to produce salivation in small doses, and in doses of three to ten grains (0.19 to 0.64 Gm.) as an alterative or purgative.

HYDRARGYRUM CUM CRETA. *U. S.* Mercury with Chalk.

	Metric.	Old form.
Mercury	38 Gm.	167 grains.
Clarified Honey	10 Gm.	48 grains.
Prepared Chalk	57 Gm.	248 grains.
Water, a sufficient quantity,		
To make	100 Gm.	1 oz. av.

Weigh the Mercury and Clarified Honey successively into a strong bottle of the capacity of 100 C.c. [old form 1 fl. oz.], and add 2 C.c. [old form 10 minims] of Water. Cork the bottle, and shake it for about half an hour at a time, until the aggregate time of shaking reaches ten hours, or until the globules of Mercury are no longer visible under a lens magnifying 4 diameters. The shaking may be more conveniently performed by mechanical means. Rub the Prepared Chalk with Water, in a mortar, to a thick, creamy paste, and, having added the contents of the bottle, washing the last portions in with a little Water, triturate the whole to a uniform mixture. Finally, dry the mixture, first between ample layers of bibulous paper, and afterwards in a capsule, at the ordinary temperature, until it weighs 100 Gm. [old form 1 oz. av.]. Then reduce it to a uniform powder, without trituration, and keep it in well-stoppered bottles, protected from light.

The intention here is to furnish mercury in a finely divided condition in the form of a powder. The above process is a very tedious one. In Matter's process, fifty-three grains of powdered acacia are mixed with fifty-three grains of chalk, enough water added to form a thin paste, and one hundred and sixty-seven grains of mercury added and triturated until extinguished. One hundred and sixty-five grains of chalk are made into a paste with water, and added to it, and the water evaporated from the mixture in a water-bath ; it is rubbed to powder when dry.

Hydrargyrum cum Creta. *U. S.*	Odor and Taste.	Solubility.
A light gray powder, free from grittiness.	Odorless; slightly sweetish taste.	Water dissolves from it the sugar of milk. When it is subsequently treated with acetic acid, the chalk is dissolved with effervescence, leaving a residue of finely divided mercury.

Test for Identity.	Impurity.	Tests for Impurity.
If a portion of the powder be digested with warm acetic acid, the filtrate should not become more than slightly opalescent on the addition of a few drops of hydrochloric acid (limit of *mercurous oxide*).	Mercuric Oxide.	If another portion of the powder be digested with warm, diluted hydrochloric acid, the filtrate should not be affected by hydrogen sulphide T.S., or by stannous chloride T.S.

Uses.—Mercury with chalk is a mild mercurial, frequently given to children. It should be free from mercurous or mercuric oxide; through exposure to air old specimens frequently contain both. The dose is five to ten grains (0.3 to 0.6 Gm.).

UNGUENTUM HYDRARGYRI. *U.S.* Mercurial Ointment.

[Blue Ointment.]

This ointment is made by extinguishing 500 Gm. of mercury with 20 Gm. of oleate of mercury; the mixture is then incorporated with 250 Gm. of lard and 230 Gm. of suet, melted together. (See Unguenta.) The object of this process is to furnish finely divided mercury in a convenient form for external administration. The ointment is largely used, and the extemporaneous process furnishes a satisfactory preparation.

EMPLASTRUM HYDRARGYRI. *U.S.* Mercurial Plaster.

This plaster contains 300 Gm. of finely divided mercury extinguished by 12 Gm. of oleate of mercury and incorporated with 688 Gm. of melted lead plaster, the whole being thoroughly mixed whilst cooling. (See Emplastra.) Its uses are the same as those of the ointment, metallic mercury in a finely divided condition being present in both, the only difference being in the form of the preparations.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. *U.S.* Ammoniac Plaster with Mercury.

This plaster contains 18 per cent. of mercury with oleate of mercury, ammoniac, diluted acetic acid, and lead plaster. (See Emplastra.) Its uses are the same as those of mercurial plaster: it is a milder external application.

HYDRARGYRUM AMMONIATUM. *U.S.* Ammoniated Mercury.

$NH_2HgCl = 251.18.$

[White Precipitate. Mercuric Ammonium Chloride.]

	Metric.	Old form.
Corrosive Mercuric Chloride, in powder	100 Gm.	1 oz. av.
Ammonia Water,		
Distilled Water, each, a sufficient quantity.		

Dissolve the Corrosive Mercuric Chloride in 2000 C.c. [old form 20 fl. oz.] of warm Distilled Water, filter the solution, and allow it to

cool. Pour the filtered liquid gradually, and with constant stirring, into 150 C.c. [old form 1½ fl. oz.] of Ammonia Water, taking care that the latter shall remain in slight excess. Collect the precipitate on a filter, and, when the liquid has drained from it as much as possible, wash it with a mixture of 400 C.c. [old form 4 fl. oz.] of Distilled Water and 20 C.c. [old form 1½ fl. dr.] of Ammonia Water. Finally, dry the precipitate between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.).

Keep the product in well-stoppered bottles, protected from light.

In this process the ammonium of one-half of the ammonium chloride, which is formed upon mixing the solutions, has two of its hydrogen atoms replaced by one atom of bivalent mercury, NH_4Cl becoming NH_2HgCl.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Water of Ammonia.}}{2NH_4HO} = \underset{\text{Ammonium Chloride.}}{NH_4Cl} + \underset{\text{Mercurammonium Chloride.}}{NH_2HgCl} + \underset{\text{Water.}}{2H_2O}.$$

Hydrargyrum Ammoniatum. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, pulverulent pieces, or a white, amorphous powder, permanent in the air. At a temperature below a red heat the salt is decomposed without fusion, and at a red heat it is wholly volatilized. When heated with potassium or sodium hydrate T.S., the salt becomes yellow and evolves vapor of ammonia.	Odorless; earthy, afterwards styptic and metallic taste.	Cold, Insoluble. Boiling, Insoluble. By prolonged washing with water it is gradually decomposed, assuming a yellow color, and becoming converted into a basic salt.	Cold, Insoluble. Boiling, Insoluble.	Readily soluble in warm hydrochloric, nitric, or acetic acid, and in a cold solution of ammonium carbonate. Also completely soluble in a cold solution of sodium hyposulphite, with the evolution of ammonia. When this solution is heated for a short time, red mercuric sulphide is separated, which, on protracted boiling, turns black.

Tests for Identity.	Impurities.	Tests for Impurities.
The solution of the salt in diluted nitric acid gives with potassium iodide T.S. a red precipitate, and with silver nitrate T.S. a white one.	Mercurous Salt.	The salt should be soluble in hydrochloric acid without residue.
	Carbonate.	The salt should be soluble in hydrochloric acid without effervescence.
	Lead.	Its solution in acetic acid should not be rendered turbid by diluted sulphuric acid.

Uses.—This compound of mercury is not used internally: it is applied externally in the form of ointment.

UNGUENTUM HYDRARGYRI AMMONIATI. *U.S.* Ointment of Ammoniated Mercury.

This ointment is made by incorporating 10 Gm. of ammoniated mercury with 90 Gm. of benzoinated lard. It is a valuable application in certain forms of eczema and psoriasis and other skin diseases.

HYDRARGYRI CHLORIDUM CORROSIVUM. *U. S.* Corrosive Mercuric Chloride.

$HgCl_2$; 270.54.

[CORROSIVE SUBLIMATE. CORROSIVE CHLORIDE OF MERCURY.]

Preparation.—This important mercuric salt may be made by the former official process, as follows:

Take of Mercury 24 oz.; Sulphuric Acid 36 oz.; Chloride of Sodium 18 oz. Boil the Mercury with the Sulphuric Acid, by means of a sand-bath, until a dry white mass is left. Rub this, when cold, with the Chloride of Sodium in an earthen-ware mortar; then sublime with a gradually increasing heat.

By boiling sulphuric acid in excess with mercury to dryness a white salt (mercuric sulphate) is formed, according to the reaction

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water}}{2H_2O.}$$

When this is mixed with sodium chloride, and the mixture exposed to a subliming heat, decomposition takes place, according to the reaction

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sodium Chloride.}}{(NaCl)_2} = \underset{\text{Sodium Sulphate.}}{Na_2SO_4} + \underset{\text{Mercuric Chloride.}}{HgCl_2.}$$

The mercuric chloride thus formed sublimes, and the sodium sulphate remains behind.

Hydrargyri Chloridum Corrosivum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Heavy, colorless, rhombic crystals or crystalline masses, permanent in the air. When heated to about 265° C. (509° F.), the salt fuses to a colorless liquid, and at about 300° C. (572° F.) it volatilizes in dense, white vapors, leaving no residue.	Odorless; acrid and persistent metallic taste; acid reaction; becomes neutral on the addition of sodium chloride.	At 15° C. (59° F.), 16 parts. Boiling, 2 parts.	Cold, 3 parts. Boiling, 1.2 parts.	Soluble in 4 parts of ether and about 14 parts of glycerin.

Tests for Identity.	Impurities.	Tests for Impurities.
With ammonia water it yields a white precipitate; with excess of hydrogen sulphide a black one; with potassium iodide T.S. a red one, soluble in an excess of the reagent; and with silver nitrate T.S. a white precipitate, insoluble in nitric acid.	Arsenic.	If the precipitated mercuric sulphide obtained in the last test be washed with water, then shaken for a few minutes with ammonia water, and filtered, the filtrate should be colorless, and, on the addition of a slight excess of hydrochloric acid, should afford neither a yellow color nor a yellow precipitate.
	Many Foreign Salts.	If a saturated, aqueous solution of the salt be heated nearly to boiling, then completely saturated with hydrogen sulphide, and allowed to stand for several hours in a well-corked flask, it should afford a colorless filtrate which, on evaporation, should leave no residue.

This chloride is always sublimed in masses, to distinguish it from mercurous chloride, or calomel, which is in powder.

Uses.—Pharmaceutically, mercuric chloride is used in several preparations to furnish the mercury in the compounds. Medicinally, as an alterative, it is one of the most valuable internal remedies in syphilis and chronic rheumatism. Externally, it is used as a stimulant and

escharotic. Recently it has been very extensively employed in antiseptic surgery. It is undoubtedly the most powerful antiseptic available, the only serious disadvantage being the necessity for great care on account of its poisonous properties. The antidote to poisoning by corrosive sublimate is the free use of white of egg, milk, or other albuminous liquids, followed by an emetic.

HYDRARGYRI CHLORIDUM MITE. *U. S.* Mild Mercurous Chloride.

$Hg_2Cl_2 = 470.84.$

[CALOMEL. MILD CHLORIDE OF MERCURY.]

Obtained in the form of powder by the rapid condensation of the vapor of Mercurous Chloride. Mild Mercurous Chloride should be kept in dark amber-colored bottles.

Preparation.—The former official process may be used to prepare mercurous chloride, as follows:

Take of Mercury 48 oz.; Sulphuric Acid 36 oz.; Chloride of Sodium 18 oz.; Distilled Water a sufficient quantity. Boil, by means of a sand-bath, 24 oz. of the Mercury with the Sulphuric Acid, until a dry white mass is left. Rub this, when cold, with the remainder of the Mercury, in an earthen-ware mortar, until they are thoroughly mixed. Then add the Chloride of Sodium, and, having rubbed it with the other ingredients until globules of Mercury cease to be visible, sublime the mixture into a large chamber so that the sublimate may fall in powder. Wash the sublimed matter with boiling Distilled Water, until the washings afford no precipitate with water of ammonia, and dry it.

In this preparation mercuric sulphate is first formed; this is then triturated with a quantity of mercury equal to that used in forming it; mercurous sulphate is produced, and when this is mixed with sodium chloride and sublimed, mercurous chloride is produced as a fine white sublimate, and sodium sulphate remains behind.

$$\underset{\text{Sulphuric Acid.}}{2H_2SO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Sulphurous Acid.}}{SO_2} + \underset{\text{Water.}}{2H_2O}.$$

$$\underset{\text{Mercuric Sulphate.}}{HgSO_4} + \underset{\text{Mercury.}}{Hg} = \underset{\text{Mercurous Sulphate.}}{Hg_2SO_4}.$$

$$\underset{\text{Mercurous Sulphate.}}{Hg_2SO_4} + \underset{\text{Sodium Chloride.}}{2NaCl} = \underset{\text{Mercurous Chloride.}}{Hg_2Cl_2} + \underset{\text{Sodium Sulphate.}}{Na_2SO_4}.$$

Hydrargyri Chloridum Mite. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, impalpable powder, becoming yellowish-white on being triturated with strong pressure, and showing only small, isolated crystals under a magnifying power of 100 diameters, permanent in the air. When strongly heated, it is wholly volatilized, without melting. The salt is blackened by ammonia water, calcium hydrate T.S., or solutions of alkali hydrates. A portion heated in a dry glass tube with dried sodium carbonate yields metallic mercury.	Odorless; tasteless.	Insoluble.	Insoluble.	Insoluble in ether, and cold dilute acids.

Tests for Identity.	Impurities.	Tests for Impurities.
On heating the salt in a test-tube with solution of potassium or sodium hydrate T.S., no odor of ammonia should be evolved; and acetic acid, agitated with the salt and filtered, should remain unaffected by hydrogen sulphide T.S., or silver nitrate T.S. (absence of and difference from *ammoniated mercury*).	Mercuric Chloride.	If 10 C.c. of distilled water or of alcohol be agitated with 1 Gm. of the salt, the filtrates should not be affected by hydrogen sulphide T.S. or silver nitrate T.S.
	Other Soluble Impurities.	If 10 C.c. of distilled water or of alcohol be agitated with 1 Gm. of the salt, the filtrates should not leave any residue on evaporation.

Uses.—Calomel is largely used as a hepatic stimulant and alterative; it is also purgative, and, in large doses, sedative. It is given in doses of one-half grain to twenty grains (0.03 to 1.3 Gm.). Care must be exercised in prescribing calomel with other remedies that the chemical action does not produce corrosive sublimate. (See U. S. Dispensatory, 17th ed., page 695.)

HYDRARGYRI CYANIDUM. *U. S.* Mercuric Cyanide.

$Hg(CN)_2$; 251.76.

Preparation.—This compound may be made by a former official process, as follows:

Take of Ferrocyanide of Potassium, 5 oz. troy; Sulphuric Acid, 4 oz. troy 120 gr.; Red Oxide of Mercury, in fine powder, Water, each, a sufficient quantity. Dissolve the Ferrocyanide of Potassium in 20 fl. oz. of Water, and add the solution to the Sulphuric Acid, previously diluted with 10 fl. oz. of Water, and contained in a glass retort. Distil the mixture nearly to dryness into a receiver, containing 10 fl. oz. of Water and 3 oz. troy of Red Oxide of Mercury. Set aside 2 fl. oz. of the distilled liquid, and to the remainder add, with agitation, sufficient Red Oxide to destroy the odor of hydrocyanic acid. Then filter the solution, and, having added the reserved liquid, evaporate the whole in a dark place, in order that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle, protected from the light.

The object of this process is to produce hydrocyanic acid by decomposing potassium ferrocyanide with sulphuric acid, and to conduct the vapor into a receiving vessel containing mercuric oxide and water. Mercuric cyanide is produced; this dissolves in the water, and the solution is evaporated and crystallized.

$$\underset{\text{Hydrocyanic Acid.}}{(HCN)_2} + \underset{\text{Mercuric Oxide.}}{HgO} = \underset{\text{Mercuric Cyanide.}}{Hg(CN)_2} + \underset{\text{Water.}}{H_2O}$$

Hydrargyri Cyanidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless or white, prismatic crystals, becoming dark-colored on exposure to light. Exceedingly poisonous. If 1 part be gently heated with 1 part of iodine in a dry test-tube, it will afford at first a yellow sublimate, which afterwards becomes red, and above this a sublimate of colorless, needle-shaped crystals will be formed.	Odorless; bitter, metallic taste; neutral reaction.	At 15° C. (59° F.), 12.8 parts. Boiling, 3 parts.	Cold, 15 parts. Boiling, 6 parts.	Very sparingly soluble in ether.

Tests for Identity.	Impurity.	Tests for Impurity.
When slowly heated, the salt decrepitates, and decomposes into metallic mercury and cyanogen gas, which is inflammable, burning with a purplish flame. On further heating, the blackish residue, containing paracyanogen and globules of metallic mercury, is wholly dissipated. On adding hydrochloric acid to the aqueous solution, hydrocyanic acid vapor is evolved.	Mercuric Chloride.	A 5-per-cent. aqueous solution of the salt should be neutral to litmus paper, and when mixed with a solution of potassium iodide T.S., should not yield a red or reddish precipitate soluble in excess of either liquid, nor should it yield a white precipitate with silver nitrate T.S.

Uses.—This cyanide is used as an alterative in syphilis, in doses of one-sixteenth to one-eighth of a grain (0.004 to 0.008 Gm.).

HYDRARGYRI IODIDUM FLAVUM. *U. S.* Yellow Mercurous Iodide.

$Hg_2I_2 = 652.66.$

[Hydrargyri Iodidum Viride, Pharm. 1880. Protiodide of Mercury. Yellow (or Green) Iodide of Mercury.]

	Metric.	Old form.
Mercury	50 Gm.	730 grains.
Nitric Acid,		
Potassium Iodide,		
Distilled Water,		
Alcohol, each, a sufficient quantity.		

Mix 20 C.c. [old form 5 fl. dr.], each, of Nitric Acid and Distilled Water, and, when the liquid is cold, pour it upon the mercury contained in a small glass flask. Set the mixture aside in a cool and dark place, and agitate it occasionally, until the reaction ceases, and a little mercury still remains undissolved. Separate the crystals of mercurous nitrate, which will have formed, from the mother-liquid, allow them to drain in a glass funnel, and dry them on bibulous paper, in a dark place. When the salt is dry, weigh off 40 Gm. [old form 584 grains] of it, and dissolve it in 1000 C.c. [old form 2 pints] of Distilled Water, to which 10 C.c. [old form 153 minims] of Nitric Acid had previously been added. Having prepared a solution of 24 Gm. [old form 350 grains] of Potassium Iodide in 1000 C.c. [old form 2 pints] of Distilled Water, slowly pour the solution of Potassium Iodide into that of the Mercurous Nitrate, with constant stirring, allow the precipitate to subside, decant the supernatant liquid, and transfer the precipitate, together with the remainder of the liquid, to a filter. When the precipitate has drained, wash it with Distilled Water until the washings no longer have an acid reaction upon litmus paper, and afterwards wash it with Alcohol, as long as the clear, colorless washings give any color with hydrogen sulphide test-solution. Lastly, dry the product in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.). Keep it in dark amber-colored vials, with the least possible exposure to light.

Instead of weighing off 40 Gm. [old form 584 grains] of the Mercurous Nitrate as above directed, the whole of the crystallized salt may

be taken and the amount of Potassium Iodide, etc., adjusted on the proportions given above.

Hydrargyri Iodidum Flavum. *U.S.*	Impurity.	Test for Impurity.
A bright yellow amorphous powder, becoming darker by exposure to light, odorless and tasteless, almost insoluble in water, and wholly insoluble in alcohol or ether. When slowly and moderately heated, it assumes at first an orange and then a red color, becoming yellow again on cooling. When quickly and strongly heated, it is at first partially decomposed into mercury and mercuric iodide, and finally is completely volatilized. When it is heated with sulphuric acid and a little manganese dioxide, vapor of iodine is evolved. In contact with a solution of potassium iodide, the salt is decomposed into mercuric iodide, which dissolves, leaving a residue of metallic mercury.	More than traces of Mercuric Iodide.	If 0.5 Gm. of the salt be shaken with 10 C.c. of alcohol, a portion of the filtrate should be scarcely affected by hydrogen sulphide T.S., nor should it produce more than a very faint, transient opalescence when dropped into water; and if 5 C.c. of the filtrate be evaporated from a white porcelain surface, not more than a very faint red stain should remain.

Uses.—Yellow mercurous iodide is used as an alterative. It is better adapted for internal administration than the red iodide, because it is milder. The dose is one grain (0.06 Gm.).

HYDRARGYRI IODIDUM RUBRUM. *U.S.* Red Mercuric Iodide.

$HgI_2 = 452.86.$

[Biniodide of Mercury. Red Iodide of Mercury.]

	Metric.	Old form.
Corrosive Mercuric Chloride	40 Gm.	584 grains.
Potassium Iodide	50 Gm.	780 grains.
Distilled Water, a sufficient quantity.		

Dissolve the Corrosive Mercuric Chloride and the Potassium Iodide, each, in 800 C.c. [old form 25½ fl. oz.] of Distilled Water, and filter the solutions separately. Pour both solutions, simultaneously and in a thin stream, under constant and very active stirring, into 2000 C.c. [old form 4 pints] of Distilled Water. When the precipitate has subsided, decant the supernatant liquid, collect the precipitate on a filter, and wash it with cold Distilled Water, until the washings give not more than a slight opalescence with silver nitrate test-solution. Finally, dry it in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.).

Keep the product in well-stoppered bottles, protected from light.

In this process mercuric iodide and potassium chloride are formed by double decomposition.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Potassium Iodide.}}{2KI} = \underset{\text{Mercuric Iodide.}}{HgI_2} + \underset{\text{Potassium Chloride.}}{2KCl.}$$

As mercuric iodide is soluble in solutions both of mercuric chloride and of potassium iodide, it is not profitable to use an excess of either.

It may be obtained in handsome crystals by dissolving it in hot hydrochloric acid to saturation and allowing the solution to cool slowly.

Hydrargyri Iodidum Rubrum. *U.S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A scarlet-red, amorphous powder, permanent in the air. When heated to about 150° C. (302° F.), the salt turns yellow, but reassumes its red color on cooling. At 238° C. (400.4° F.) it fuses to a dark yellow liquid, which on cooling forms a yellow, crystalline mass, and, at higher temperatures, volatilizes without decomposition, leaving no residue.	Odorless; tasteless.	Almost insoluble.	At 15° C. (59° F.), 130 parts. Boiling, 15 parts.	Soluble in solution of potassium iodide or of mercuric chloride, and in a solution of sodium hyposulphite.

Tests for Identity.	Impurities.	Tests for Impurities.
On heating the salt with potassium or sodium hydrate T.S., and adding a little sugar of milk, metallic mercury is precipitated. If the salt be heated with sulphuric acid and some manganese dioxide, vapor of iodine will be given off.	Soluble Iodides or Chlorides.	If 10 C.c. of water is agitated with 0.5 Gm. of the salt, the filtered liquid should not become more than very slightly colored by hydrogen sulphide T.S., nor give more than a slight opalescence with silver nitrate T.S.
	Mercuric Chloride.	If the salt be dissolved in hot alcohol, the solution, after cooling, should be colorless, and when this solution is diluted with an equal volume of water it should not redden blue litmus paper.

Uses.—This iodide is used internally in the treatment of syphilis, in doses of one-sixteenth of a grain (0.004 Gm.); it is frequently given in pill form combined with potassium iodide. Externally, it is often used in the form of an ointment, of the strength of sixteen grains to the ounce, which was formerly official.

HYDRARGYRI OXIDUM FLAVUM. *U. S.* Yellow Mercuric Oxide.

HgO; 215.76.

	Metric.	Old form.
Corrosive Mercuric Chloride	100 Gm.	1460 grains.
Soda	40 Gm.	584 grains.
Distilled Water, a sufficient quantity.		

Dissolve the Corrosive Mercuric Chloride in 1000 C.c. [old form 2 pints] of warm Distilled Water, and filter the solution. Dissolve the Soda (which should contain 90 per cent. of sodium hydrate) in 1000 C.c. [old form 2 pints] of cold Distilled Water, and into this solution pour gradually, and with constant stirring, the solution of Corrosive Mercuric Chloride. Allow the mixture to stand for an hour at a temperature of about 30° C. (86° F.), stirring frequently. Then decant the supernatant, clear liquid from the precipitate, and wash the latter repeatedly by the affusion and decantation of Distilled Water, using 1000

C.c. [old form 2 pints] of Water each time. Collect the precipitate on a strainer, and continue the washing with warm Distilled Water, until a small portion of the washings, when poured on a little mercuric chloride test-solution, no longer produces a yellowish turbidity at the line of contact of the two liquids. Then allow the precipitate to drain, and dry it between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.).

Keep the product in well-stoppered bottles, protected from light.

$$\underset{\text{Mercuric Chloride.}}{HgCl_2} + \underset{\text{Potassium Hydrate.}}{2KHO} = \underset{\text{Mercuric Oxide.}}{HgO} + \underset{\text{Potassium Chloride.}}{2KCl} + \underset{\text{Water.}}{H_2O}.$$

Hydrargyri Oxidum Flavum. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A light orange-yellow, heavy, amorphous, impalpable powder, permanent in the air, and turning darker on exposure to light. When moderately heated, it assumes a red color; at a red heat it is completely decomposed, giving off oxygen and separating metallic mercury, and is finally volatilized without residue.	Odorless; somewhat metallic taste.	Almost insoluble.	Insoluble.	Readily and completely soluble in diluted hydrochloric acid or nitric acid, forming colorless solutions.

Tests for Identity.
If 0.5 Gm. of the Oxide be digested on a water-bath for fifteen minutes, with a solution of 1 Gm. of oxalic acid in 10 C.c. of water, it will be converted into white mercuric oxalate (distinction from *red mercuric oxide*).
On dissolving 1 Gm. of the Oxide in 100 C.c. of diluted nitric acid, the resulting solution should be clear, and should not afford more than a slight opalescence with silver nitrate T.S. (limit of *chloride*).

Uses.—Yellow mercuric oxide is used in making the oleate of mercury and in the official ointment: it is employed only externally.

UNGUENTUM HYDRARGYRI OXIDI FLAVI. *U. S.* Ointment of Yellow Mercuric Oxide.

This preparation is made by incorporating 10 Gm. of yellow mercuric oxide with 90 Gm. of ointment. Its uses are the same as those of the older ointment of red mercuric oxide. (See Unguenta.)

OLEATUM HYDRARGYRI. *U. S.* Oleate of Mercury.

This oleate is made by dissolving 20 Gm. of dried yellow mercuric oxide in 80 Gm. of oleic acid. It is best to avoid heat in making this preparation, to prevent partial decomposition and separation of metallic mercury; in time this change slowly takes place, even when the directions have been strictly followed (see page 342).

HYDRARGYRI OXIDUM RUBRUM. *U. S.* Red Mercuric Oxide.

HgO; 215.76. [RED PRECIPITATE.]

Preparation.—This oxide may be made by a former official process, as follows:

Take of Mercury 36 oz.; Nitric Acid 24 oz.; Water 2 pints. Dissolve the Mercury, with the aid of a gentle heat, in the Acid and Water previously mixed, and evaporate to dryness. Rub the dry mass into powder, and heat it in a very shallow vessel until red vapors cease to rise.

Mercuric nitrate is first formed, and this is decomposed by heat.

$$\underset{\text{Mercuric Nitrate.}}{(Hg2NO_3)_2} = \underset{\text{Mercuric Oxide.}}{(HgO)_2} + \underset{\text{Nitrogen Dioxide.}}{4NO_2} + \underset{\text{Oxygen.}}{O_2}.$$

It is more economical to add an equal weight of mercury to the mercuric nitrate, before heating, as it also may be converted into oxide through the escaping nitrogen dioxide and heat.

Hydrargyri Oxidum Rubrum. *U. S.*	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvents.
Heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided, permanent in the air. When heated to about 400° C. (752° F.) it becomes dark violet or almost black, but assumes its original color on cooling. At a red heat it is completely decomposed, giving off oxygen and separating metallic mercury, and is finally volatilized without residue.	Odorless; somewhat metallic taste.	Almost insoluble.	Insoluble.	Wholly soluble in diluted nitric or hydrochloric acid, forming colorless solutions.

Tests.	Impurity.	Test for Impurity.
When 0.5 Gm. is digested, on a water-bath, with a solution of 1 Gm. of oxalic acid in 10 C.c. of water, it does not change color within two hours (distinction from *yellow mercuric oxide*). On dissolving 1 Gm. of the Oxide in 100 C.c. of diluted nitric acid, the resulting solution should be clear, and should not afford more than a slight opalescence with silver nitrate T.S. (limit of *chloride*).	Nitrate.	When strongly heated in a test-tube, the vapors should not redden moistened blue litmus paper.

Uses.—Red mercuric oxide has the same chemical composition as the yellow oxide. It is used in the form of ointment for inflamed eyelids, in skin diseases, and for destroying body-vermin.

UNGUENTUM HYDRARGYRI OXIDI RUBRI. *U. S.* Ointment of Red Mercuric Oxide.

This preparation, usually known as red precipitate ointment, is made by incorporating 10 Gm. of red mercuric oxide with 5 Gm. of castor oil and 85 Gm. of ointment. It is used as a stimulating application to indolent sores and in blepharitis.

HYDRARGYRI SUBSULPHAS FLAVUS. *U.S.* Yellow Mercuric Subsulphate.

$Hg(HgO)_2SO_4$; 727.14.

[BASIC MERCURIC SULPHATE. TURPETH MINERAL.]

	Metric.	Old form.
Mercury	100 Gm.	1640 grains.
Sulphuric Acid	30 C.c.	460 minims.
Nitric Acid	25 C.c.	384 minims.
Distilled Water, a sufficient quantity.		

Upon the Mercury, contained in a capacious flask, pour the Sulphuric Acid, previously mixed with 15 C.c. [old form 230 minims] of Distilled Water, then add, very gradually, the Nitric Acid, previously mixed with 25 C.c. [old form 384 minims] of Distilled Water, and digest at a gentle heat until reddish fumes are no longer given off. Transfer the mixture to a porcelain capsule, and heat it on a sand-bath, under a hood, or in the open air, with frequent stirring, until a dry, white mass remains. Reduce this to a fine powder, and add it in small portions at a time, with constant stirring, to 2000 C.c. [old form 4 pints] of boiling Distilled Water. When all has been added, continue the boiling for ten minutes; then allow the mixture to settle, decant the supernatant liquid, transfer the precipitate to a strainer, wash it with warm Distilled Water, until the washings no longer have an acid reaction, and dry it in a moderately warm place.

Keep the product in well-stoppered bottles, protected from light.

When normal mercuric sulphate ($HgSO_4$) is mixed with boiling water it is decomposed, and basic mercuric sulphate, $Hg(HgO)_2SO_4$, separates, as a yellow precipitate, whilst acid mercuric sulphate remains in solution.

Hydrargyri Subsulphas Flavus. *U.S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, lemon-yellow powder, permanent in the air. When heated, the salt turns red, becoming yellow again on cooling. At a red heat it is volatilized, evolving vapors of mercury and of sulphur dioxide, leaving no residue.	Odorless; almost tasteless.	At 15° C. (59° F.), 2000 parts. Boiling, 600 parts.	Insoluble.	Soluble in nitric or hydrochloric acid.

TESTS FOR IDENTITY.

To prove the absence of mercurous salt or of lead, this compound should be soluble in 10 parts of hydrochloric acid without residue.
A solution of the salt in nitric or hydrochloric acid, diluted with water, gives with potassium iodide T.S. a red precipitate, and with barium chloride T.S. a white one.

Uses.—This mercurial salt is rarely used. It is powerfully irritant, and may be replaced by milder mercurials with advantage. The dose, as an alterative, is from one-quarter to one-half grain (0.016 to 0.032 Gm.).

LIQUOR HYDRARGYRI NITRATIS. *U. S.* **Solution of Mercuric Nitrate.**

A liquid containing about 60 per cent. of Mercuric Nitrate [$Hg(NO_3)_2$ = 323.58], together with about 11 per cent. of free Nitric Acid.

	Metric.	Old form.
Red Mercuric Oxide	40 Gm.	4 oz. av.
Nitric Acid	45 Gm.	8 fl. oz.
Distilled Water	15 Gm.	1 fl. oz. 3½ fl. dr.
To make	100 Gm.	about 4½ fl. oz.

Mix the Nitric Acid with the Distilled Water, and dissolve the Red Mercuric Oxide in the mixture.

Keep the product in glass-stoppered bottles.

Liquor Hydrargyri Nitratis. *U. S.*	Odor and Reaction.
A clear, nearly colorless, heavy liquid. Sp. gr. about 2.100 at 15° C. (59° F.). A few drops evaporated on a porcelain capsule leave a white residue, which, on heating, becomes yellow, red, and brown, and is finally entirely volatilized. On a bright surface of copper, the Solution deposits a coating of mercury.	Faint odor of nitric acid; strongly acid reaction.

Tests for Identity.	Impurity.	Tests for Impurity.
The diluted Solution affords, with potassium or sodium hydrate T.S., a yellow precipitate, and with potassium iodide T.S., a bright red one, soluble in excess of the reagent. A clear crystal of ferrous sulphate, dropped into the Solution, rapidly acquires a brown color and becomes surrounded by a brownish-black zone.	Mercurous Salt.	No precipitation or cloudiness should occur in the Solution on the addition of distilled water or of diluted hydrochloric acid.

Uses.—This is a corrosive liquid, used principally to cauterize malignant ulcerations, cancers, etc. It is never given internally.

UNGUENTUM HYDRARGYRI NITRATIS. *U. S.* **Ointment of Mercuric Nitrate.**

[Citrine Ointment.]

This important ointment is made by heating 760 Gm. of lard oil to a temperature of 100° C. (212° F.), and then adding, *without stirring*, 70 Gm. of nitric acid, continuing the heat as long as moderate effervescence continues, and then allowing the mixture to cool; 70 Gm. of mercury are dissolved in 105 Gm. of nitric acid with the aid of sufficient heat, and this solution is added to the ointment before it has become entirely cold. When nitric acid is added to lard oil under the above circumstances, the *olein* of the oil is converted into elaïdin, and the color changes to a deep orange: this, upon stirring and cooling, becomes lighter, and it has received the name of citrine ointment. It is used in various skin diseases and in inflammation of the eyelids. (See Unguenta.)

QUESTIONS ON CHAPTERS XLV. AND XLVI.

NICKEL, COBALT, TIN, LEAD, COPPER, SILVER, MERCURY.

Nickel—What is the Latin name? Give symbol and atomic weight.
Give description and specific gravity. Where is it obtained?
What alloy does it form with copper?
For what purpose are the salts of nickel used?
What are the tests for compounds of nickel?
Cobalt—Give symbol and atomic weight. Give description and specific gravity.
How is it found? What classes of salts does it form?
What is flystone, and how is it used?
What is barometer paper, and what is the explanation of its use?
Are any of the salts of cobalt officinal?
What are the tests for salts of cobalt?
Tin—Give symbol and atomic weight.
Give description and specific gravity.
What classes of salts does it form?
What are the tests for compounds of tin?
Lead—Give Latin name, symbol, and atomic weight.
Give description and specific gravity.
How is it obtained?
What compounds does it form with oxygen?
What are the tests for compounds of lead?
Is water rendered poisonous by passing through lead pipes?
Lead acetate—Give Latin name, formula in symbols, and molecular weight.
What is its synonyme?
How is it made? Describe rationale of process.
Is the commercial salt fit for pharmaceutical use? Why?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc; alkalies, or alkaline earths; copper.
What is the dose?
Why is solution of lead acetate in water turbid?
Solution of lead subacetate—How much lead subacetate does this solution contain?
How is it prepared, and what is the object of the process? Describe rationale of process.
What is its specific gravity? Describe odor, taste, and chemical reaction.
How may its strength be tested?
What is its popular name?
What are its properties and uses in medicine?
Diluted solution of lead subacetate—Why is this solution usually opalescent?
Is this an advantage or a disadvantage? Why?
For what is it used?
Cerate of lead subacetate—How is it prepared, and what are its properties?
What is its popular name?
How may it be prevented from turning yellow?
Lead carbonate—Give the formula in symbols and molecular weight.
How may this salt be prepared by the pharmacist?
How is the commercial article prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc; alkalies, or alkaline earths.
What are its uses?
Ointment of lead carbonate—How is it made? What is its use?
Lead iodide—What is the British process for making this salt?
Why is lead nitrate preferred to the acetate?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc; alkalies, or alkaline earths.
Ointment of lead iodide—How is it made? What is its use?

Lead nitrate—Give Latin official name, formula in symbols, and molecular weight.
How may this salt be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Zinc; alkalies, or alkaline earths; copper.
How is it used?
Lead oxide—Give Latin official name, formula in symbols, and molecular weight.
How is the commercial salt usually obtained?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Carbonate; zinc; alkalies, or alkaline earths.
What is red lead, and how is it made?
Lead plaster—What is it, and how is it made?
For what is it used?
Diachylon ointment—What is it, and for what is it used?
Copper—Give Latin name.
What is its symbol? What is its atomic weight? Give description and specific gravity.
How is it found?
What oxides does it form? Give their formulas.
What are the tests for compounds of copper?
Copper sulphate—Give formula in symbols and molecular weight.
How is it made?
How much water of crystallization does it contain?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Foreign metals; alkalies, or alkaline earths.
What is the dose?
Silver—Give Latin name, symbol, and atomic weight. Give description and specific gravity.
How is it found?
What combination does it make with oxygen?
What are the tests for silver salts?
Silver cyanide—Give formula in symbols and molecular weight.
How is it prepared? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
For what is it used?
Silver iodide—Give formula in symbols and molecular weight.
How may it be made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of chloride be detected?
What is the dose?
Silver nitrate—Give formula in symbols and molecular weight.
Give the process (formerly official) by which this may be made.
How is the copper separated from the silver, with which it is usually mixed, in making this solution?
Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the foreign metallic impurities be detected?
What is the dose?
Diluted silver nitrate—How is it made?
What is the object of this preparation?
Describe odor, taste, and chemical reaction.
For what is it used?
Moulded silver nitrate—How is it made?
What is the object of adding hydrochloric acid?
How may it be prevented from becoming discolored during the process of casting?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may its quality be tested?
For what is it used?
How may a convenient caustic-holder be made?
Silver oxide—Give Latin name, formula in symbols, and molecular weight.
Describe the process (formerly official) by which it may be made.
Describe rationale of process. Describe odor, taste, chemical reaction, and solubility.
How may impurity of carbonate be detected?

What is its use? Why should it not be triturated with oxidizable or combustible substances?
What action does ammonia have upon it?
Mercury—Give Latin name, symbol, and atomic weight.
Describe it and give specific gravity.
How is it found, and where does it come from?
At what temperature does it solidify?
What two series of compounds does it form?
Is it used in medicine in the metallic state?
What are the tests for compounds of mercury?
How may mercury be purified?
Describe odor, taste, and chemical reaction.
How may the following impurities be detected?—viz.: Tin and other metals; moisture; organic impurities; more than slight traces of foreign metals.
For what is it used medicinally?
Mass of mercury—Give the Latin name.
How is it made?
What is the object of this preparation? What is the dose?
Mercury with chalk—How is it made?
What is the object of this preparation?
What is Matter's process for making it?
What is the dose?
Mercurial ointment—How is it made?
What is the object of this preparation?
Mercurial plaster—How is it made?
What percentage of mercury does it contain?
Ammoniac plaster with mercury—How much mercury does it contain?
For what purpose is it used?
Ammoniated mercury—Give formula in symbols and molecular weight.
How is it made? Give rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Mercurous salt; carbonate; lead.
How is it used?
Ointment of ammoniated mercury—How is it made?
For what is it used?
Corrosive mercuric chloride—Give Latin name, symbolic formula, and molecular weight.
Describe the process (formerly official) by which it may be made.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of arsenic be detected?
In case of poisoning, what are the proper antidotes?
Mild mercurous chloride—Give Latin name, symbolic formula, and molecular weight.
Describe the process (formerly official) by which it may be made.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Mercuric chloride; fixed soluble impurities.
What is the dose? What caution is necessary in prescribing calomel?
Mercuric cyanide—Give Latin name, symbolic formula, and molecular weight.
Describe the process (formerly official) by which it may be made.
What is the object of this process? Give rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of mercuric chloride be detected?
What is the dose?
Red mercuric iodide—Give Latin name, formula in symbols, and molecular weight.
How is it made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Soluble iodide; chloride.
What is the dose?
Yellow mercurous iodide—Give Latin name, symbolic formula, and molecular weight.
How is it made?
What is the object of washing this salt with alcohol?
Describe odor, taste, and chemical reaction. What is the dose?

Yellow mercuric oxide—How is it prepared? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
For what is it used?
Ointment of yellow mercuric oxide—How is it made, and for what is it used?
Oleate of mercury—What is the Latin name?
How is it made?
Red mercuric oxide—What is the Latin name?
Give the formula in symbols and molecular weight.
Describe the process (formerly official) by which this may be made.
Give rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of nitrate be detected?
Wherein does it differ from yellow mercuric oxide?
For what is it used?
Ointment of red mercuric oxide—What is the Latin name?
How is it made, and for what is it used?
Yellow mercuric subsulphate—Give the formula in symbols and molecular weight.
How is it made? Give rationale of process.
Describe odor, taste, chemical reaction, and solubility.
How may the presence of mercurous salt be tested?
What is the dose?
Solution of mercuric nitrate—What is the Latin name?
Give description and specific gravity.
How much mercuric nitrate does this solution contain?
How is it made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the presence of mercurous salt be indicated?
What is its use?
Ointment of mercuric nitrate—How is it made? Give rationale of process.
For what is it used?

CHAPTER XLVII.

ANTIMONY, ARSENIC, AND BISMUTH.

Sb; 119.6. As; 74.9. Bi; 208.9.

THESE three metals, which have the Latin names Antimonium, Arsenium, Bismuthum, form a group which presents several analogies. Arsenic is regarded by a number of chemists as not metallic, and on account of some of its chemical relations it is classed by them with the non-metallic elements, but in some of its physical properties, notably its lustre, specific gravity, etc., it closely resembles the metals, and it is therefore considered in the group with antimony and bismuth.

Antimony (Stibium). Sb; 119.6.

This metal is found in nature in a free state, and as a sulphide, oxide, or oxysulphide. The native sulphide is the chief source of the metal, and roasting with iron and sodium sulphide is the process generally resorted to for obtaining it. It is a brittle, brilliant metal, of a lamellated texture, of a silver-white color when pure, but bluish-white as it occurs in commerce. When rubbed between the fingers, it imparts a sensible odor. Its sp. gr. is 6.7, and its fusing point 425° C. (797° F.), or about a red heat. It forms three combinations with oxygen,—*antimony trioxide* (antimonous oxide), Sb_2O_3, *antimony tetroxide,* Sb_2O_4 (by some considered to be an antimonate of the teroxide of antimony, Sb_4O_8), and *antimony pentoxide* (antimonic oxide), Sb_2O_5. The first of these unites with water to form antimonous acid, the salts of which are called *antimonites;* the third unites with water to form antimonic acid, the salts of which are called *antimonates.*

Tests for Salts of Antimony.

1. If hydrogen sulphide be added to an acidified solution of salt of antimony, an orange-red precipitate of sulphide will be produced. This is soluble in ammonium sulphide, but is again precipitated upon the addition of an acid.

2. If hydrochloric acid be added to the sulphide, so as to form a strong solution of antimonous chloride, and this be mixed with water, a white precipitate of oxychloride will be produced.

3. Zinc and iron precipitate antimony as a black powder from its solutions, copper precipitates it as a metallic film; this may be dissolved

by potassium permanganate, and this solution will yield antimony sulphide with hydrogen sulphide.

Official Preparations of Antimony.

Official Name.	Preparation.
Antimonii et Potassii Tartras	By boiling antimonous oxide and acid potassium tartrate together with water, evaporating, and crystallizing.
Antimonii Oxidum	By adding antimonous chloride to water, and treating the oxychloride formed with ammonia water.
Antimonii Sulphidum	By purifying antimony ore by fusion.
Antimonii Sulphidum Purificatum	By macerating antimonous sulphide with water containing a trace of ammonia water.
Antimonium Sulphuratum	By boiling antimonous sulphide with solution of soda and adding sulphuric acid to the hot solution.
Pilulæ Antimonii Compositæ	Each pill contains about ½ gr. sulphurated antimony, ½ gr. mild mercurous chloride, and 1 gr. guaiac, made into a mass with castor oil.
Pulvis Antimonialis	33 Gm. antimony oxide, 67 Gm. precipitated calcium phosphate.
Vinum Antimonii	4 Gm. antimony and potassium tartrate, 65 Gm. distilled water, 150 C.c. alcohol, and sufficient white wine to make 1000 C.c.

Unofficial Salts of Antimony.

Antimonii Bromidum, $SbBr_3$. Antimony Bromide.	By adding dry antimony to bromine contained in a retort, agitating until the combination is complete, then purifying by distillation, and collecting the crystals.
Antimonii Fluoridum, $SbFl_3$. Antimony Fluoride.	By placing antimony and mercury fluoride in a retort, distilling, and collecting the white mass.
Antimonii Iodidum, SbI_3. Antimony Iodide.	By direct combination of the elements.
Antimonii Oxysulphidum, Sb_2S_3 and Sb_2O_3. Antimony Oxysulphide.	By boiling 1 p. black antimony with 250 p. water containing 23 p. sodium carbonate, filtering, and collecting the precipitate.
Antimonii Pentasulphidum. Antimony Pentasulphide.	By adding 70 p. crystallized sodium carbonate to 250 p. water and boiling; then mixing with 26 p. lime and 80 p. water; lastly, adding 36 p. levigated antimony sulphide and 7 p. sublimed sulphur, boiling until the gray color disappears, filtering, and then crystallizing.
Antimonii Sulphas, $Sb_2(SO_4)_3$. Antimony Sulphate.	By boiling antimony with strong sulphuric acid, and collecting the white mass.

ANTIMONII ET POTASSII TARTRAS. *U.S.* Antimony and Potassium Tartrate.

$$2K(SbO)C_4H_4O_6 + H_2O = 662.42.$$

[TARTAR EMETIC. TARTARATED ANTIMONY.]

Antimony and Potassium Tartrate should be kept in well-stoppered bottles.

This, the most important antimonial compound, may be made by a former official process, as follows:

Take of Oxide of Antimony, in very fine powder, 2 oz.; Bitartrate of Potassium, in very fine powder, 2½ oz.; Distilled Water, 18 fl. oz. To the Water, heated to the boiling point in a glass vessel, add the

powders, previously mixed, and boil for an hour; then filter the liquid while hot, and set it aside that crystals may form. Lastly, dry the crystals, and keep them in a well-stopped bottle. By further evaporation the mother-water may be made to yield more crystals, which should be purified by a second crystallization.

Like potassium and sodium tartrate, this is a double salt. Two replaceable hydrogen atoms of tartaric acid ($H_2C_4H_4O_6$) are substituted by one of antimonyl (SbO) and one of potassium (K). The group (SbO) is hypothetical.

$$\underset{\text{Acid Potassium Tartrate.}}{2KHC_4H_4O_6} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} = \underset{\text{Antimony Potassium Tartrate.}}{2KSbOC_4H_4O_6} + \underset{\text{Water.}}{H_2O.}$$

Antimonii et Potassii Tartras. *U.S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent crystals of the rhombic system, becoming opaque and white on exposure to air, or a white granular powder. When heated to 110° C. (230° F.), the salt loses its water of crystallization. When heated to redness, the salt chars, emits the odor of burnt sugar, and leaves a blackened residue of an alkaline reaction.	Odorless; sweet, afterwards disagreeable, metallic taste; feebly acid reaction.	At 15° C. (59° F.), 17 parts. Boiling, 3 parts.	Insoluble. It precipitates it from its aqueous solution in the form of a crystalline powder.

Tests.	Impurities.	Tests for Impurities.
The aqueous solution of the salt yields, with hydrochloric acid, a white precipitate soluble in an excess of the acid; but no precipitate occurs if tartaric acid has been previously added. In a solution of the salt acidulated with hydrochloric acid, hydrogen sulphide T.S. produces an orange-red precipitate. A dilute solution at once becomes permanently turbid on the addition of a little potassium carbonate or calcium hydrate T.S.	Sulphate.	A 1-per-cent. aqueous solution of the salt, previously acidulated with acetic acid, should not be clouded by the addition of a few drops of barium chloride T.S.
	Iron and other Metals.	A 1-per-cent. aqueous solution of the salt, previously acidulated with acetic acid, should not be clouded by the addition of a few drops of potassium ferrocyanide T.S.
	Calcium.	A 1-per-cent. aqueous solution of the salt, previously acidulated with acetic acid, should not be clouded by the addition of a few drops of ammonium oxalate T.S.
If 0.331 Gm. of the crystallized salt, or 0.322 Gm. of the salt dried at 110° C. (230° F.), be dissolved in 10 C.c. of water, and about 20 C.c. of a cold, saturated solution of sodium bicarbonate, and a little starch T.S. added, it should require not less than 20 C.c. of decinormal iodine V.S. to produce a permanent blue color. (*Corresponds to 100 per cent. of pure salt.*)	Chloride.	A 1-per-cent. aqueous solution of the salt, previously acidulated with acetic acid, should not be clouded by the addition of a few drops of silver nitrate T.S.
	More than traces of Arsenic.	If 1 Gm. of the salt be dissolved, with the aid of heat, in hydrochloric acid, and to this solution 1 C.c. of stannous chloride T.S. be added (see List of Reagents, Bettendorff's Test for Arsenic), no turbidity or coloration should ensue within one hour.
	Potassium Bitartrate.	On adding sodium carbonate T.S. to crushed crystals of the salt, effervescence should not ensue.

Uses.—Tartar emetic, as its name implies, is used as an emetic, in doses of half a grain to one grain (0.03 to 0.06 Gm.), repeated until vomiting takes place. It is given in minute doses as an alterative or diaphoretic. In cases of poisoning by an overdose, tannin should be administered in some form, freely: the insoluble tannate is formed.

ANTIMONII OXIDUM. *U. S.* Antimony Oxide.

$Sb_2O_3 = 287.06$. [ANTIMONY TRIOXIDE.]

Preparation.—The former official process may be used in making this oxide. It is as follows:

Take of Sulphide of Antimony, in very fine powder, 4 oz. troy; Hydrochloric Acid, 18 oz. troy; Nitric Acid, 1 oz. troy, 120 grains; Water of Ammonia, 1½ fl. oz.; Water, Distilled Water, each, a sufficient quantity. Introduce the Sulphide into a flask, of the capacity of two pints, and, having added the Hydrochloric Acid, digest, by means of a sand-bath, until effervescence ceases. Then, having removed the flask from the sand-bath, add the Nitric Acid gradually; and, when nitrous acid vapors cease to be given off, and the liquid has grown cold, add to it half a pint of Water, and filter. Pour the filtered liquid gradually into twelve pints of Water, constantly stirring, and allow the precipitate to subside. Decant the supernatant liquid, and wash the precipitate twice by decantation, using, each time, eight pints of Water. Then transfer it to a muslin filter to drain, and, after the draining is completed, wash it with Water until the washings cease to have an acid reaction. Next introduce it into a suitable vessel, and subject it to the action of the Water of Ammonia for two hours; at the end of which time transfer it to a moistened muslin filter, and wash it with Distilled Water as long as the washings produce a precipitate with nitrate of silver. Lastly, dry the precipitate upon bibulous paper with the aid of a gentle heat.

The first step in this process is the formation of antimonous chloride, $SbCl_3$. When this is added to water it is decomposed, an oxychloride being formed, $2SbCl_3.5Sb_2O_3$. This is converted into oxide by treating it with ammonia.

$$\underset{\substack{\text{Antimony}\\\text{Sulphate.}}}{Sb_2S_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid.}}}{6HCl} = \underset{\substack{\text{Antimonous}\\\text{Chloride.}}}{2SbCl_3} + \underset{\substack{\text{Hydrogen}\\\text{Sulphide.}}}{3H_2S};$$

then

$$\underset{\substack{\text{Antimonous}\\\text{Chloride.}}}{12SbCl_3} + \underset{\text{Water.}}{15H_2O} = \underset{\substack{\text{Antimony}\\\text{Oxychloride.}}}{2SbCl_3.5Sb_2O_3} + \underset{\substack{\text{Hydrochloric}\\\text{Acid.}}}{30HCl},$$

and

$$\underset{\substack{\text{Antimony}\\\text{Oxychloride.}}}{2SbCl_3,5Sb_2O_3} + \underset{\text{Ammonia.}}{6NH_3} + \underset{\text{Water.}}{3H_2O} = \underset{\substack{\text{Antimony}\\\text{Oxide.}}}{6Sb_2O_3} + \underset{\substack{\text{Ammonium}\\\text{Chloride.}}}{6NH_4Cl}.$$

Antimonii Oxidum. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, grayish-white powder, permanent in the air.	Odorless; tasteless.	Almost insoluble.	Insoluble.	Hydrochloric acid dissolves it without effervescence; soluble in warm solution of tartaric acid, and in boiling solution of potassium bitartrate; insoluble in nitric acid.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated, the Oxide turns yellow, becoming white again on cooling, and at a dull red heat fuses to a yellowish liquid, which concretes, on cooling, to a crystalline mass of a pearly color. At a higher temperature it sublimes, producing colorless and transparent, or white, shining, needle-shaped crystals. On dropping its solution in hydrochloric acid into water, a white precipitate is formed, which is immediately changed to orange by hydrogen sulphide T.S.	Chloride.	If 1 Gm. of the Oxide be dissolved with the aid of 5 Gm. of tartaric acid in a little water, and the solution diluted with water to the measure of 100 C.c., portions of this solution should not be affected by test-solutions of silver nitrate.
	Sulphate.	If 1 Gm. of the Oxide be dissolved with the aid of 5 Gm. of tartaric acid in a little water, and the solution diluted with water to the measure of 100 C.c., portions of this solution should not be affected by barium chloride T.S.
	Iron and other Metals.	If 1 Gm. of the Oxide be dissolved with the aid of 5 Gm. of tartaric acid in a little water, and the solution diluted with water to the measure of 100 C.c., portions of this solution should not be affected by potassium ferrocyanide T.S.
	Copper and Lead.	If a solution of the Oxide in hydrochloric acid be diluted with water, until it just begins to become permanently turbid, and then precipitated with hydrogen sulphide, this precipitate, when collected and thoroughly washed, should be completely soluble in ammonium sulphide T.S.
	Arsenic.	If 1 Gm. of the Oxide be dissolved in hydrochloric acid, and to this solution 1 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic) be added, no turbidity or coloration should ensue within one hour.

Uses.—This oxide is rarely given uncombined; internally, it is the active ingredient in the official antimonial powder (Pulvis Antimonialis). It is used in the preparation of tartar emetic.

ANTIMONII SULPHIDUM. *U. S.* Antimony Sulphide.

$Sb_2S_3 = 335.14.$

[Antimony Trisulphide.]

Native Antimony Sulphide, purified by fusion, and as free from arsenic as possible.

Preparation.—The crude antimony ore is purified by placing it in melting-pots, which are connected with the receiving-pots by earthenware tubes; the infusible substances remain in the melting-pots, and are separated from the fused mass, and the latter, when cold, in the form of conical masses or loaves, is called *crude antimony*.

Antimonii Sulphidum. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Steel-gray masses of a metallic lustre and a striated, crystalline fracture, forming a black or grayish-black, lustreless powder, permanent in the air. When heated, it fuses to a dark brown liquid at a temperature below red heat.	Odorless; tasteless.	Insoluble.	Insoluble.	1 part of powdered sulphide, when boiled with 10 parts of hydrochloric acid, dissolves without leaving more than a slight residue, hydrogen sulphide being evolved.

Tests for Identity.
If 1 Gm. of the powdered sulphide be digested and finally boiled with 10 C.c. of hydrochloric acid, it should dissolve without leaving more than 1 per cent. of residue. This acid solution, completely deprived of hydrogen sulphide by boiling, yields, when added to water, a white precipitate, which is soluble in a solution of tartaric acid. After the separation of the precipitate by filtration, the filtrate yields an orange-red precipitate with hydrogen sulphide T.S.

Uses.—Antimony sulphide is used almost exclusively in veterinary practice as an alterative.

ANTIMONII SULPHIDUM PURIFICATUM. *U.S.* **Purified Antimony Sulphide.**

$Sb_2S_3 = 335.14.$ [Purified Antimony Trisulphide.]

	Metric.	Old form.
Antimony Sulphide	**100 Gm.**	16 oz. av.
Ammonia Water	**50 C.c.**	8 fl. oz.
Water, a sufficient quantity.		

Reduce the Antimony Sulphide to a very fine powder. Separate the coarser particles by elutriation, and, when the finely divided Sulphide has been deposited, pour off the water, add the Ammonia Water, and macerate for five days in a well-closed vessel, agitating the mixture frequently. Then let the powder settle, pour off the Ammonia Water, and wash the residue by repeated affusion and decantation of Water. Finally, dry the product by the aid of a gentle heat.

The intention of this process is to purify the commercial sulphide from arsenous sulphide, the latter being soluble in ammonia. Hager prefers to use a solution of ammonium carbonate with the ammonia, because it is more economical, antimony sulphide being less soluble in the mixture.

Antimonii Sulphidum Purificatum. *U.S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvent.
A heavy, grayish-black, lustreless powder, permanent in air. It fuses at a temperature below red heat to a dark brown liquid.	Odorless; tasteless.	Insoluble.	Insoluble.	When boiled with 10 parts of hydrochloric acid it is nearly all dissolved, hydrogen sulphide being evolved.

Tests for Identity.	Impurities.	Tests for Impurities.
The acid solution, when added to water, yields a white precipitate, which is soluble in a solution of tartaric acid. After separation of the precipitate by filtration, the filtrate gives an orange-red precipitate with hydrogen sulphide T.S.	Other Metallic Sulphides.	If 2 Gm. of the salt be mixed and cautiously ignited, in a porcelain crucible, with 8 Gm. of pure sodium nitrate, and, after cooling, the fused mass be boiled with 25 C.c. of water, there will remain a residue which should be white, or nearly so, and not yellowish nor brownish.
	More than traces of Arsenic.	On boiling the filtrate separated from the last-mentioned residue with a slight excess of nitric acid, until no more nitrous vapors are evolved, then dissolving in it 0.1 Gm. of silver nitrate, filtering again, if necessary, and cautiously pouring a few drops of ammonia water on top, not more than a white cloud, but no red nor reddish precipitate, should appear at the line of contact of the two liquids.

Uses.—Purified antimony sulphide should be used exclusively in all the preparations into which the sulphide enters. It is not used internally to any extent.

ANTIMONIUM SULPHURATUM. *U.S.* Sulphurated Antimony.

[KERMES MINERAL.]

Chiefly Antimony Trisulphide [$Sb_2S_3 = 335.14$], with a very small amount of Antimony Trioxide.

	Metric.	Old form.
Purified Antimony Sulphide	100 Gm.	3 oz. av. 148 gr.
Solution of Soda	1200 C.c.	38½ fl. oz.
Distilled Water,		
Diluted Sulphuric Acid, each, a sufficient quantity.		

Mix the Purified Antimony Sulphide with the Solution of Soda and 3000 C.c. [old form 6 pints] of Distilled Water, and boil the mixture over a gentle fire for two hours, with frequent stirring, and occasionally adding Distilled Water so as to preserve the same volume. Strain the liquid immediately through a double muslin strainer, and drop into it, while yet hot, Diluted Sulphuric Acid so long as it produces a precipitate. Wash the precipitate with hot Distilled Water until the washings are at most but very slightly clouded by barium chloride T.S.; then dry the precipitate at a temperature not exceeding 25° C. (77° F.), and rub it to a fine powder.

Keep the product in well-stoppered bottles, protected from light.

When antimonous sulphide is boiled with solution of sodium hydrate, sodium antimonite and sodium sulph-antimonite are formed, and when sulphuric acid is added to the hot solution, these salts are decomposed, and antimonous sulphide and antimonous oxide are precipitated, whilst sodium sulphate remains in solution.

$$\underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Sodium Hydrate.}}{6NaHO} = \underset{\text{Sodium Antimonite.}}{Na_3SbO_3} + \underset{\text{Sodium Sulph-Antimonite.}}{Na_3SbS_3} + \underset{\text{Water.}}{3H_2O.}$$

and

$$\underset{\text{Sodium Antimonite.}}{2Na_3SbO_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Oxide.}}{Sb_2O_3} + \underset{\text{Water.}}{3H_2O.}$$

and

$$\underset{\text{Sodium Sulph-Antimonite.}}{2Na_3SbS_3} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Sodium Sulphate.}}{3Na_2SO_4} + \underset{\text{Antimonous Sulphide.}}{Sb_2S_3} + \underset{\text{Hydrogen Sulphide.}}{3H_2S.}$$

Antimonium Sulphuratum. *U.S.*	Odor and Taste.	Solubility. Water.	Alcohol.	Other Solvent.
A reddish-brown, amorphous powder, becoming lighter in color on exposure to light. If 1 Gm. of Sulphurated Antimony be gently heated with 10 C.c. of hydrochloric acid, it should dissolve with the exception of a slight residue, which, when washed and dried, should burn, on the application of a flame, with the characteristic odor of sulphur, and should leave not more than a scanty ash.	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in hydrochloric acid with the evolution of hydrogen sulphide.

Tests for Identity.	Impurities.	Tests for Impurities.
The acid solution, completely deprived of hydrogen sulphide, yields, when added to water, a white precipitate, which, after washing and drying, should weigh not less than 85 per cent. of the sulphide. The liquid filtered from this precipitate yields an orange-red precipitate with hydrogen sulphide T.S.	Sulphate.	If 1 Gm. of Sulphurated Antimony be shaken with 20 C.c. of hot water, the filtrate should be neutral to test-paper, and should not be rendered more than slightly opalescent by barium chloride T.S.
When tested for arsenic, as described under Purified Antimony Sulphide, it should afford no reaction beyond the limit prescribed for the latter.	Chloride.	If 1 Gm. of Sulphurated Antimony be shaken with 20 C.c. of hot water, the filtrate should be neutral to test paper, and should not be rendered more than slightly opalescent by silver nitrate T.S.
	Calcium.	If 1 Gm. of Sulphurated Antimony be shaken with 20 C.c. of hot water, the filtrate should be neutral to test-paper, and should not be affected by ammonium oxalate T.S.

Uses.—Sulphurated antimony is alterative, emetic, and diaphoretic, in doses of one to five grains (0.06 to 0.3 Gm.).

PILULÆ ANTIMONII COMPOSITÆ. *U.S.* Compound Pills of Antimony.

[PLUMMER'S PILLS.]

Each pill contains about one-half grain of sulphurated antimony, one-half grain of mild mercurous chloride, and one grain of guaiac, with sufficient castor oil to form a mass. This pill is used in secondary syphilis and in various skin diseases. (See Pilulæ.)

PULVIS ANTIMONIALIS. *U.S.* Antimonial Powder.

[JAMES' POWDER.]

This powder is made from 33 Gm. of antimony oxide and 67 Gm. of precipitated calcium phosphate. It is used as a diaphoretic, in doses of three to five grains (0.19 to 0.3 Gm.). (See Pulveres.)

VINUM ANTIMONII. *U.S.* Wine of Antimony.

Made by dissolving 4 Gm. of antimony and potassium tartrate in 65 C.c. of boiling distilled water and 150 C.c. of alcohol, and adding sufficient white wine to make 1000 C.c. It is used as an addition to diaphoretic and expectorant mixtures. The dose is ten to twenty minims (0.6 to 1.2 C.c.).

Arsenic. As; 74.9.

Arsenic is found in many minerals, generally as a sulphide or an arsenide. It may be easily obtained from arsenous oxide by heating it with charcoal. Arsenic is a brilliant, crystalline element, of a steel-gray color when freshly sublimed; upon exposure to the air its surface becomes blackish and dull. Its sp. gr. is 5.73 to 5.88. It forms two combinations with oxygen, arsenous and arsenic oxides, As_2O_3 and As_2O_5 respectively, the corresponding acid to each of which is known, and three with sulphur, namely, the disulphide, or *realgar*, As_2S_2; the

trisulphide, or *orpiment*, As_2S_3, corresponding in composition to arsenous oxide; and the pentasulphide, As_2S_5, corresponding to arsenic oxide.

Tests for Arsenic and its Salts.

1. Hydrogen sulphide, when added to an acidulated solution of arsenous acid, produces a bright yellow precipitate (orpiment). This is soluble in ammonia water and reprecipitated by acids.

2. If silver nitrate is added to a solution of arsenous acid, with a small quantity of ammonia water, a yellow precipitate (silver arsenite) is produced. This precipitate is soluble in an excess of ammonia, and also in nitric acid.

3. If cupric sulphate is added to a solution of arsenous acid, with a small quantity of ammonia water, a green precipitate (Scheele's green) is produced. This precipitate is soluble in an excess of ammonia.

4. If a liquid containing arsenic be added to a flask containing zinc and sulphuric acid, the hydrogen gas produced will upon ignition deposit a ring of metallic arsenic upon a cold surface (Marsh's test).

5. If a thin piece of bright copper plate be placed in an acidulated arsenical solution, and the latter be heated, a film of metallic arsenic will be deposited upon it (Reinsch's test).

Official Preparations of Arsenic.

Official Name.	Preparation.
Acidum Arsenosum	By roasting arsenical ores and resubliming the sublimate.
Liquor Acidi Arsenosi	10 Gm. arsenous acid, 50 C.c. diluted hydrochloric acid, distilled water to make 1000 C.c.
Liquor Potassii Arsenitis	10 Gm. arsenous acid, 20 Gm. potassium bicarbonate, 30 C.c. compound tincture of lavender, distilled water to make 1000 C.c.
Sodii Arsenas	By fusing arsenous acid with sodium nitrate and sodium carbonate.
Liquor Sodii Arsenatis	By dissolving 1 Gm. sodium arsenate in sufficient distilled water to make 100 C.c.
Arseni Iodidum	By fusing 1 part arsenic and 5 parts iodine together.
Liquor Arseni et Hydrargyri Iodidi	By dissolving 10 Gm. each of arsenic iodide and mercuric iodide in 1000 C.c. of distilled water.

Unofficial Compounds of Arsenic.

Arseni Bisulphidum, As_2S_2. Arsenic Bisulphide.	By fusing together 5 parts arsenous acid and 3 parts sulphur, then collecting the mass.
Arseni Bromidum, $AsBr_3$. Arsenic Bromide.	By diffusing arsenic in powder in a retort filled with bromine vapor, then distilling the arsenic bromide from the excess of arsenic.
Arseni Chloridum, $AsCl_3$. Arsenic Chloride.	By direct combination of arsenic and chlorine.
Arseni Trisulphidum, As_2S_3. Arsenic Trisulphide.	By fusing 5 parts arsenous acid with 4 to 5 parts sulphur, then collecting the mass.

ACIDUM ARSENOSUM. *U.S.* Arsenous Acid.

As_2O_3; 197.68. [ARSENIC TRIOXIDE. WHITE ARSENIC.]

Preparation.—Arsenous acid, or, as it is commonly termed, arsenic, is made by roasting arsenical ores in reverberatory furnaces with long

horizontal flues: the arsenous acid collects as a solid sublimate, which is afterwards resublimed in cast-iron vessels with conical heads. Chemically, it is not regarded as an acid, but is an oxide, As_2O_3, the true acid being formed when the oxide is dissolved in water.

$$\underset{\text{Arsenous Trioxide.}}{2As_2O_3} + \underset{\text{Water.}}{6H_2O} = \underset{\text{Arsenous Acid.}}{4H_3AsO_3}.$$

Acidum Arsenosum. U. S.	Odor, Taste, etc.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, white solid, occurring either as an opaque powder, or in irregular masses of two varieties: the one amorphous, transparent and colorless, like glass; the other crystalline, opaque or white, resembling porcelain; frequently the same piece has an opaque outer crust enclosing the glassy variety; contact with moist air gradually changes the glassy into the opaque variety. Heated to about 218° C. (424.4° F.), it is completely volatilized without melting, and when thrown on ignited charcoal it emits an alliaceous odor. When its vapor is passed through red-hot charcoal, in an arsenic-tube, it is deoxidized, and metallic arsenic is deposited as a mirror, with a metallic lustre, on the cooler portions of the tube.	Odorless; tasteless; faintly acid reaction.	Cold, 30 to 80 parts. Boiling, 15 parts.	Cold, Sparingly. Boiling, Sparingly.	Freely by hydrochloric acid, the alkalies and their carbonates. Soluble in about 5 parts glycerin. Oil of turpentine dissolves the glassy variety.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Silver ammonium nitrate T.S. produces in an aqueous solution of the acid a lemon-yellow precipitate, which dissolves on the addition of ammonia water, and, when this solution is heated, metallic silver is deposited (distinction from *arsenic acid*); a grass-green precipitate is produced by copper ammonium sulphate T.S., which dissolves in ammonia water, with a deep blue color; and, if the solution is acidulated with hydrochloric acid, a bright yellow one with hydrogen sulphide T.S. This latter precipitate, which is *arsenic trisulphide*, is soluble in ammonium carbonate T.S. (absence of *antimony*, *tin*, and *cadmium*).	Non-volatile Matter and Arsenic Sulphide.	Heated in a dry test-tube of hard glass, it sublimes without leaving a residue, and the sublimate does not show at first a yellow or other color.
If 0.1 Gm. of the acid be dissolved, with 1 Gm. of sodium bicarbonate, in 20 C.c. of water, and gently heated, the solution should decolorize not less than 20 C.c. of decinormal iodine V.S. (corresponding to at least 98.5 per cent. of pure arsenic trioxide).	Metallic Impurities, Sulphides, etc.	If 1 part of Arsenous Acid is dissolved in 10 parts of ammonia water and gently heated, the solution should neither leave an insoluble residue nor show a yellow or other color; nor should the addition of a slight excess of hydrochloric acid produce a precipitate.

Uses.—Arsenous acid is used as an alterative, in doses of one-twentieth of a grain (0.003 Gm.); externally, it is employed as an escharotic, and, mixed with various substances in the form of a paste, is often applied to cancers and ulcers. Two antidotes to arsenical poisoning are official (see page 680).

LIQUOR ACIDI ARSENOSI. *U. S.* **Solution of Arsenous Acid.**

	Metric.	Old form.
Arsenous Acid	10 Gm.	87 grains.
Diluted Hydrochloric Acid	50 C.c.	192 minims.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	8 fl. oz.

Mix the Diluted Hydrochloric Acid with 250 C.c. [old form 2 fl. oz.] of Distilled Water, add the Arsenous Acid, and boil the mixture until all the Arsenous Acid is dissolved. Filter the solution, and pass enough Distilled Water through the filter to make the product measure 1000 C.c. [old form 8 fl. oz.]. Mix thoroughly.

This is simply a solution of arsenous acid in diluted hydrochloric acid, no chemical action taking place. The official quantitative test is as follows:

If 24.7 C.c. of Solution of Arsenous Acid be boiled for a few minutes with 2 Gm. of sodium bicarbonate, the liquid cooled, diluted with water to 100 C.c., and mixed with a little starch T.S., it should require from 49.4 to 50 C.c. of decinormal iodine V.S. to produce a blue tint (corresponding to 1 per cent. of arsenous acid of the required purity).

Uses.—This solution is used as an alterative, in doses of two to five minims (0.12 to 0.3 C.c.).

LIQUOR POTASSII ARSENITIS. *U. S.* **Solution of Potassium Arsenite.**

[FOWLER'S SOLUTION.]

	Metric.	Old form.
Arsenous Acid, in fine powder	10 Gm.	74 grains.
Potassium Bicarbonate	20 Gm.	148 grains.
Compound Tincture of Lavender	30 C.c.	4 fl. dr.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Boil the Arsenous Acid and Potassium Bicarbonate with 100 C.c. [old form $1\frac{1}{2}$ fl. oz.] of Distilled Water, until solution has been effected. Then add enough Distilled Water to make the solution, when cold, measure 970 C.c. [old form $15\frac{1}{2}$ fl. oz.], and, lastly, add the Compound Tincture of Lavender. Filter through paper.

$$\underset{\text{Acid Potassium Carbonate.}}{2KHCO_3} + \underset{\text{Arsenous Oxide.}}{As_2O_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Potassium Arsenite.}}{2KH_2AsO_3} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

When arsenous oxide is boiled with acid potassium carbonate in concentrated solution, carbon dioxide is evolved, and potassium arsenite is produced; but, owing to the fact that the salts are soluble in the quantity of water directed in the formula, a solution can be effected without involving any chemical change. The proportionate quantity of potassium bicarbonate was doubled in the U. S. P. 1890. The corresponding British solution (Liquor Arsenicalis) is made from dilute solutions, and its title does not indicate any chemical action. The official quantitative test is as follows:

If 24.7 C.c. of the Solution be boiled with 2 Gm. of sodium bi-

carbonate, the liquid, when cold, diluted with 100 C.c. of water, and some gelatinized starch added, should require from 49.4 to 50 C.c. of decinormal iodine V.S. to produce a blue tint (corresponding to 1 per cent. of arsenous acid of the required purity).

Uses.—Solution of potassium arsenite is largely used as an alterative, in doses of three to five minims (0.18 to 0.3 C.c.).

SODII ARSENAS. *U. S.* Sodium Arsenate.

$Na_2HAsO_4.7H_2O$; 311.46.

For an account of the preparation and uses of this salt, see page 557.

LIQUOR SODII ARSENATIS. *U. S.* Solution of Sodium Arsenate.

	Metric.	Old form.
Sodium Arsenate, deprived of its water of crystallization by a heat not exceeding 149° C. (300.2° F.) . .	1 Gm.	87 grains.
Distilled Water, a sufficient quantity,		
To make	100 C.c.	8 fl. oz.

Dissolve the Sodium Arsenate in a sufficient quantity of Distilled Water to make 100 C.c. [old form 8 fl. oz.].

ARSENI IODIDUM. *U. S.* Arsenic Iodide.

AsI_3; 454.49.

Preparation.—In the former official process this iodide was made by a direct combination of the elements.

Take of Arsenic, 60 grains; Iodine, 300 grains. Rub the Arsenic in a mortar until reduced to a fine powder; then add the Iodine, and rub them together until they are thoroughly mixed. Put the mixture into a small flask or a test-tube, loosely stopped, and heat it very gently until liquefaction occurs. Then incline the vessel in different directions, in order that any portion of the iodine, which may have condensed on its surface, may be returned into the melted mass. Lastly, pour the melted iodide on a porcelain slab, and, when it is cold, break it into pieces, and keep it in a well-stoppered bottle.

By this process it is difficult to secure entire combination, and it has been made by dissolving the iodine in carbon disulphide, and gradually adding the finely powdered metallic arsenic until the purple color, showing the presence of free iodine, has disappeared; the solution is then evaporated and crystallized.

Arseni Iodidum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Glossy, orange-red, crystalline masses, or shining, orange-red, crystalline scales, gradually losing iodine when exposed to the air. By heat the salt is completely volatilized.	Iodine-like odor; iodine-like taste; neutral reaction.	At 15° C. (59° F.), 7 parts. Boiling, Gradually decomposed.	Cold, 30 parts. Boiling, Gradually decomposed.	Soluble in ether and carbon disulphide.

Tests for Identity.
The aqueous solution has a yellow color, and, on standing, gradually decomposes into arsenous and hydriodic acids. On adding hydrogen sulphide T.S. to the solution, acidulated with hydrochloric acid, a lemon-yellow precipitate is deposited. If the salt be heated with diluted nitric acid, vapor of iodine will be given off.

Uses.—The principal use of this compound is in making solution of arsenic and mercuric iodide. The dose is one-sixteenth of a grain (0.004 Gm.) as an alterative.

LIQUOR ARSENI ET HYDRARGYRI IODIDI. *U. S.* Solution of Arsenic and Mercuric Iodide.

[DONOVAN'S SOLUTION.]

	Metric.	Old form.
Arsenic Iodide	10 Gm.	78 grains.
Red Mercuric Iodide	10 Gm.	78 grains.
Distilled Water, a sufficient quantity,		
To make	1000 C.c.	1 pint.

Powder the Arsenic Iodide, and mix it with the Red Mercuric Iodide by trituration. Add 150 C.c. [old form 2½ fl. oz.] of Distilled Water, and continue the trituration until solution is effected. Filter the solution, and pass enough Distilled Water through the filter to make the product measure 1000 C.c. [old form 1 pint]. Mix thoroughly.

This solution, in which no chemical change occurs, should be of a light straw color; when darker than this, free iodine is probably present, and if a globule of mercury and a few grains of metallic arsenic are dropped into the bottle containing the solution, and the whole well agitated and filtered, the proper color may be restored.

Uses.—Solution of arsenic and mercuric iodide is used as an alterative. The dose is from three to five minims (0.18 to 0.3 C.c.), largely diluted.

Bismuth. Bi; 208.9.

Bismuth is found in the metallic state, and occasionally as a sulphide. It is a crystalline, brittle, pulverizable, brilliant metal, having a silver color with a reddish tint. Its sp. gr. is 9.8. It closely resembles metallic antimony in appearance.

Tests for Salts of Bismuth.

1. Hydrogen sulphide or ammonium sulphide produces in solutions of bismuth salts a black precipitate of sulphide, insoluble in excess.
2. When acid solutions of bismuth salts are poured into water, white precipitates (subsalts) are produced.

Official Preparations of Bismuth.

Official Name.	Preparation.
Bismuthi Citras	By boiling bismuth subnitrate with citric acid and water, and adding distilled water to the clear solution.
Bismuthi et Ammonii Citras	By dissolving bismuth citrate in ammonia water, evaporating the solution, and scaling.
Bismuthi Subcarbonas	By dissolving bismuth in nitric acid, purifying, and precipitating by adding solution of sodium carbonate.
Bismuthi Subnitras	By dissolving bismuth in nitric acid, purifying, and adding the solution in nitric acid to water.

Unofficial Preparations of Bismuth.

Bismuthi Bromidum, $BiBr_3$. Bismuth Bromide.	By treating bismuth with excess of bromine and collecting the steel-gray mass.
Bismuthi Chromas, $3Bi_2O_3.2CrO_3$. Bismuth Chromate.	By adding a solution of bismuth nitrate to a moderately concentrated solution of acid potassium chromate in slight excess, and collecting the precipitate.
Bismuthi Lactas. Bismuth Lactate.	By boiling 10 p. bismuth subnitrate with excess of soda, washing the oxide well with water, then mixing with 9 p. lactic acid, digesting the mixture, and drying in a water-bath.
Bismuthi Oxalas, $C_6Bi_2O_{12}.15H_2O$. Bismuth Oxalate.	By mixing bismuth nitrate with a solution of oxalic acid, and collecting the precipitate.
Bismuthi Oxidum, Bi_2O_3. Bismuth Oxide.	By mixing 4 oz. bismuth subnitrate and 1 pint solution of soda, then boiling for 5 minutes, decanting the liquid, and washing the precipitate with distilled water.
Bismuthi Oxychloridum, BiOCl. Bismuth Oxychloride.	By pouring slowly a solution of bismuth in nitric acid into a solution of sodium chloride, and collecting the precipitate.
Bismuthi Phosphas, $BiPO_4$. Bismuth Phosphate.	By adding bismuth nitrate to a solution of phosphoric acid containing nitric acid, and collecting the precipitate.
Bismuthi Salicylas. Bismuth Salicylate.	By dissolving bismuth nitrate in glycerin and adding a concentrated solution of sodium salicylate, then collecting the precipitate.
Bismuthi Tannas. Bismuth Tannate.	By dissolving 22 p. bismuth nitrate in the least amount of nitric acid, previously diluted with half its weight of water, pouring the solution into an excess of solution of soda, washing the precipitate with water, then triturating the precipitate with 10 p. tannin diluted with water, straining and drying.
Bismuthi Tartras. Bismuth Tartrate.	By adding a hot, concentrated solution of 4 p. tartaric acid to a hot, moderately strong solution of 5 p. bismuth oxide in nitric acid, then washing the precipitate with an aqueous solution of tartaric acid.
Bismuthi Valerianas. Bismuth Valerianate.	By dissolving bismuth nitrate in the smallest amount of nitric acid, previously diluted with half its weight of water, then adding a concentrated solution of sodium valerianate, washing the precipitate with water mixed with valerianic acid, and, lastly, drying the precipitate.

BISMUTHI CITRAS. *U. S.* Bismuth Citrate.

$BiC_6H_5O_7 = 397.44.$

	Metric.	Old form.
Bismuth Subnitrate	100 Gm.	3 oz. av. 148 gr.
Citric Acid	70 Gm.	2 oz. av. 148 gr.
Distilled Water, a sufficient quantity.		

Boil the Bismuth Subnitrate and the Citric Acid with 400 C.c. [old form 13 fl. oz.] of Distilled Water for about fifteen minutes, or until a drop of the mixture yields a clear solution with ammonia water. Then add 5000 C.c. [old form 10 pints] of Distilled Water, allow the

suspended matter to deposit, wash the precipitate, first by decantation, and afterwards on a strainer, with Distilled Water, until the washings are tasteless, and dry the residue at a gentle heat.

In this process the bismuth salt is decomposed by the boiling solution of citric acid.

$$\underset{\text{Bismuth Subnitrate.}}{BiONO_3.H_2O} + \underset{\text{Citric Acid.}}{H_3C_6H_5O_7} = \underset{\text{Bismuth Citrate.}}{BiC_6H_5O_7} + \underset{\text{Nitric Acid.}}{HNO_3} + \underset{\text{Water.}}{2H_2O.}$$

Bismuthi Citras. *U. S.*	Odor and Taste.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A white, amorphous or micro-crystalline powder, permanent in the air.	Odorless; tasteless.	Insoluble.	Insoluble.	Soluble in ammonia water, and in solutions of the citrates of the alkalies.

Tests for Identity.	Impurity.	Test for Impurity.
When strongly heated, the salt chars, and, on ignition, leaves a more or less blackened residue with a yellow surface, which is dissolved by warm nitric acid. This solution, on being dropped into water, occasions a white turbidity. The ammoniacal solution, when treated with hydrogen sulphide in excess, yields a black precipitate. The filtrate, deprived, by heat, of the excess of hydrogen sulphide and cooled, when boiled with lime water, produces a white precipitate.	Nitrate.	When a portion of the filtrate obtained by treating the ammoniacal solution with hydrogen sulphide in excess is deprived of the excess of hydrogen sulphide by heating, and is mixed with an equal volume of concentrated sulphuric acid and again cooled, no brown or brownish-black color should appear around a crystal of ferrous sulphate dropped into the liquid.

Uses.—This salt may be used for the same purposes as the subnitrate. It was made official because it is used in making the soluble double salt of bismuth and ammonium citrate.

BISMUTHI ET AMMONII CITRAS. *U. S.* Bismuth and Ammonium Citrate.

	Metric.	Old form.
Bismuth Citrate	100 Gm.	1 oz. av.
Ammonia Water,		
Distilled Water, each, a sufficient quantity.		

Mix the Bismuth Citrate with 200 C.c. [old form 2 fl. oz.] of Distilled Water to a smooth paste, heat the mixture on a water-bath, and gradually add Ammonia Water, until the salt is dissolved, and the liquid is neutral or has only a faintly alkaline reaction. Then filter the solution, evaporate it on a water-bath to a syrupy consistence, and spread it upon plates of glass, so that, when dry, the salt may be obtained in scales.

Keep the product in small, well-stoppered bottles, protected from light.

This is the only soluble salt of bismuth official. If its aqueous solution is not perfectly transparent, it is probably due to the loss of

ammonia on keeping the salt: a drop or two of ammonia water added to the cloudy solution will generally make it transparent.

Liquor Bismuthi.—An aqueous solution of bismuth citrate has been largely used in England. It may be made by dissolving 260 grains of bismuth and ammonium citrate in 14 fl. oz. of distilled water, neutralizing the solution with ammonia water, and adding 2 fl. oz. of alcohol.

Bismuthi et Ammonii Citras. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Small, shining, pearly or translucent scales, becoming opaque on exposure to air. When strongly heated, the salt melts, and finally leaves a more or less blackened residue with a yellow surface, which is dissolved by warm nitric acid. This solution, on being dropped into water, occasions a white turbidity.	Odorless; slightly acidulous and metallic taste; neutral or faintly alkaline reaction.	Very soluble.	Sparingly soluble.

Tests for Identity.	Impurity.	Test for Impurity.
The aqueous solution of the salt, when boiled with potassium or sodium hydrate, evolves vapor of ammonia, and, when treated with hydrogen sulphide, yields a black precipitate. If the filtrate from the latter be deprived, by heat, of the excess of hydrogen sulphide and cooled, a portion of it, boiled with lime water, produces a white precipitate.	Nitrate.	When a portion of the cooled filtrate, obtained by treating an aqueous solution of the salt with hydrogen sulphide, is deprived of the excess of acid by heating, and is mixed with an equal volume of concentrated sulphuric acid and again cooled, there should be produced no brown or brownish-black color around a crystal of ferrous sulphate when dropped into the liquid.

Uses.—This salt is astringent, and is generally prescribed in solution. The dose is from one to three grains (0.06 to 0.18 Gm.).

BISMUTHI SUBCARBONAS. *U. S.* Bismuth Subcarbonate.

Preparation.—Bismuth subcarbonate may be made by the former official process, as follows:

Take of Bismuth, in pieces, 2 oz. troy; Nitric Acid 8½ oz. troy; Water of Ammonia 5 fl. oz.; Carbonate of Sodium 10 oz. troy; Distilled Water a sufficient quantity. Mix 4½ oz. troy of the Nitric Acid with 4 fl. oz. of Distilled Water in a capacious glass vessel, and, having added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with 10 fl. oz. of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper. To the filtered liquid, previously diluted with 4 pints of Distilled Water, slowly add the Water of Ammonia, constantly stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with 2 pints of Distilled Water, and drain it again. Then place the precipitate in a proper vessel, add the remainder of the Nitric Acid, and afterwards 4 fl. oz. of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper. Dissolve the Carbonate of Sodium in 12 fl. oz. of Distilled Water, with

the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless. Lastly, press, dry it on bibulous paper with a gentle heat, and rub it into powder.

As metallic bismuth generally contains arsenic, it is very important to provide that this should be left behind, in the processes for making its medicinal preparations. It is on this account that the above formula is so elaborate. The bismuth is first dissolved in nitric acid, a portion of which oxidizes the metal, with the evolution of nitrous vapors, while another portion combines with the oxide produced to form bismuth nitrate. At the same time the arsenic is also oxidized at the expense of the nitric acid, and unites with a portion of the oxidized metal so as to produce bismuth arsenate. Both of these salts, therefore, are contained in the solution, which is very concentrated. Both have the property, when their solution is diluted with water, of separating into two salts, one an insoluble subsalt which is deposited, and the other a soluble acid salt which is held in solution. But the arsenate is more disposed to the change than the nitrate, and requires for the purpose a smaller amount of water of dilution. The subarsenate is slowly deposited in twenty-four hours, and is then separated by filtration. The addition of a large quantity of distilled water precipitates the bismuth subnitrate, the ammonia being added to separate it more thoroughly by combining with the nitric acid. The precipitate, thus freed from arsenic, is now redissolved in nitric acid partially diluted and added to solution of sodium carbonate; by double decomposition, bismuth subcarbonate and sodium nitrate are thus produced.

Bismuthi Subcarbonas. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white or pale yellowish-white powder, of somewhat varying chemical composition, permanent in the air. When heated to redness, the salt loses water and carbon dioxide, and leaves from 87 to 91 per cent. of a yellow residue which is soluble in nitric or hydrochloric acid and blackened by hydrogen sulphide.	Odorless; tasteless.	Insoluble.	Insoluble.	Completely soluble in nitric or hydrochloric acid, with copious effervescence.

Impurities.	Tests for Impurities.
	If 3 Gm. of the salt be dissolved in just a sufficient quantity (about 4 C.c.) of warm nitric acid, and the solution poured into 100 C.c. of water, a white precipitate is produced. After filtering and evaporating the filtrate on a water-bath to 30 C.c., again filtering, and dividing this filtrate into portions of 5 C.c., they should respond to the following tests:
Lead.	On mixing one portion with an equal volume of diluted sulphuric acid, it should not become cloudy.
Copper.	If another portion be precipitated with a slight excess of ammonia water, the supernatant liquid should not exhibit a bluish tint.

TESTS.—*Continued.*

IMPURITIES.	TESTS FOR IMPURITIES.
Chloride.	Other portions should not be affected by silver nitrate T.S.,
Sulphate.	Or by barium nitrate T.S.,
Silver.	Nor yield, with hydrochloric acid, a precipitate which is insoluble in a slight excess of the latter.
Alkalies and Alkaline Earths.	If 1 Gm. of the salt be boiled with 10 C.c. of a mixture of equal parts of acetic acid and water, the solution cooled and filtered, and the filtrate freed from bismuth by hydrogen sulphide, and again filtered, the last filtrate should leave no residue on evaporation.
Ammonia.	On boiling 1 Gm. of the salt with 10 C.c. of potassium or sodium hydrate T.S., it should not evolve the odor of ammonia.
Nitrate.	If 1 Gm. of the salt be added to 10 C.c. of a mixture of equal parts of concentrated sulphuric acid and water tinged slightly blue with indigo T.S., on heating the bluish tint should not be discharged.
Arsenic.	If 1 Gm. of the salt be ignited in a porcelain crucible, and the residue, when cold, dissolved in 5 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), no dark coloration or precipitate should be produced within fifteen minutes.

Uses.—This bismuth compound is astringent and tonic. It is employed for the same purposes as the subnitrate: the latter is much more frequently used. The dose is five to ten grains (0.3 to 0.6 Gm.).

BISMUTHI SUBNITRAS. *U.S.* Bismuth Subnitrate.

Preparation.—This important salt may be made by the former official process, as follows:

Take of Bismuth, in pieces, 2 oz. troy; Nitric Acid 8½ oz. troy; Carbonate of Sodium 10 oz. troy; Water of Ammonia 5 fl. oz.; Distilled Water a sufficient quantity. Mix 4½ oz. troy of the Nitric Acid with 4 fl. oz. of Distilled Water, in a capacious glass vessel, and, having added the Bismuth, set the whole aside for twenty-four hours. Dilute the resulting solution with 10 fl. oz. of Distilled Water, stir it thoroughly, and, after twenty-four hours, filter through paper. Dissolve the Carbonate of Sodium in 20 fl. oz. of Distilled Water with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with Distilled Water until the washings pass tasteless, and drain again as completely as possible. Then place the moist precipitate in a capacious vessel, gradually add the remainder of the Nitric Acid, and afterwards 4 fl. oz. of Distilled Water, and set the solution aside. At the end of twenty-four hours, filter through paper, and to the filtered liquid, previously diluted with 4 pints of Distilled Water, slowly add the Water of Ammonia, with constant stirring. Transfer the whole to a strainer, and, after the precipitate has been drained, wash it with 2 pints of Distilled Water, drain it again, and press out as much of the liquid as possible. Lastly, dry it upon bibulous paper with a gentle heat, and rub it into powder.

The separation of the arsenic is accomplished by first preparing the carbonate, by adding the acid solution of bismuth to a solution of sodium carbonate in excess, whereby most of the arsenic is retained in

the solution, probably as sodium arsenate, while the insoluble carbonate is precipitated. This is dissolved, with the aid of heat, in nitric acid, so as to make a very concentrated solution of the nitrate, to which, when cold, just so much water is added as to begin to produce a permanent turbidness. The object of this is to allow any arsenic that may be still present to be deposited, which happens for reasons stated in explaining the process for procuring the subcarbonate (see page 750). The deposited matter having been precipitated, only the pure nitrate remains in solution, which is made to yield the subnitrate by large dilution with water, and still more completely by the addition of ammonia.

$$\underset{\text{Bismuth.}}{Bi_2} + \underset{\text{Nitric Acid.}}{8HNO_3} = \underset{\text{Bismuth Nitrate.}}{(Bi3NO_3)_2} + \underset{\text{Water.}}{4H_2O} + \underset{\text{Nitrogen Monoxide.}}{2NO};$$

then

$$\underset{\text{Bismuth Nitrate.}}{5(Bi3NO_3)} + \underset{\text{Water.}}{8H_2O} = \underset{\text{Bismuth Subnitrate.}}{4BiONO_3H_2O} + \underset{\text{Bismuth Nitrate.}}{Bi3NO_3} + \underset{\text{Nitric Acid.}}{8HNO_3}.$$

Bismuthi Subnitras. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy white powder, of somewhat varying chemical composition, permanent in the air.	Odorless; almost tasteless; slightly acid reaction.	Almost insoluble.	Insoluble.	Soluble in nitric or hydrochloric acid.

Test for Identity.	Impurities.	Tests for Impurities.
When heated to 120° C. (248° F.), the salt gives off water (between 3 and 5 per cent. of its weight), and when subsequently heated to redness it evolves nitrous vapors, leaving from 79 to 82 per cent. of its weight of a yellow residue which is soluble in nitric or in hydrochloric acid, and blackened by hydrogen sulphide.	Carbonate.	On dissolving 3 Gm. of the salt in 3 C.c. of warm nitric acid, no effervescence should occur.
	Water.	If the above solution be poured into 100 C.c. of water, a white precipitate is produced. If the filtrate, separated from the above precipitate, be evaporated on a water-bath to 30 C.c., the liquid again filtered, and the new filtrate divided into portions of 5 C.c. each, these should respond to the tests for purity described under *Bismuthi Subcarbonas.*
	Insoluble Foreign Salts.	No residue should be left by treating 1 part of the salt with 5 parts of nitric acid (sp. gr. 1.200).
	Alkalies and Alkaline Earths.	When further tested as described under *Bismuthi Subcarbonas*, the salt should be free from alkalies and alkaline earths,
	Ammonia.	And should give no reaction for ammonia.
	Arsenic.	If 1 Gm. of the salt be heated, in a porcelain crucible, until nitrous vapors cease to be evolved, and the residue, when cold, dissolved in 5 C.c. of stannous chloride T.S. (see List of Reagents, Bettendorff's Test for Arsenic), no dark coloration or precipitate should be produced within fifteen minutes.

Uses.—Bismuth subnitrate is largely used in intestinal disorders: it is astringent, tonic, and sedative. The dose is from three to ten grains (0.19 to 0.6 Gm.).

QUESTIONS ON CHAPTER XLVII.

ANTIMONY, ARSENIC, AND BISMUTH.

Antimony—Give Latin name, symbol, and atomic weight.
What is its melting-point? How is it found?
What combinations does it form with oxygen?
From which of these oxides are antimonites formed?
From which of these oxides are antimoniates formed?
What are the tests for salts of antimony?
Antimony and potassium tartrate—Give Latin name, formula in symbols, and molecular weight.
Describe the process (formerly official) by which this may be made.
Give rationale of the process. Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—viz.: Sulphate; iron and other metals; calcium; chloride; more than traces of arsenic.
In case of poisoning by an overdose, what is the proper antidote?
Antimony oxide—Give formula in symbols and molecular weight.
Give rationale of the process. Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—viz.: Chloride; sulphate; iron and other metals.
In what official preparations is it used?
Antimony sulphide—Give Latin name, formula in symbols, and molecular weight.
What was its name in the U.S. Pharm. 1870?
How is it prepared? What is crude antimony? For what is it used?
Purified antimony sulphide—Give Latin name, formula in symbols, and molecular weight.
How is it prepared? What is the object of this process?
Give rationale of the process. Describe odor, taste, chemical reaction, and solubility. What are the tests for identity?
How may the following impurities be detected?—viz.: Other metallic sulphides; more than traces of arsenic.
For what is it used?
Sulphurated antimony—What is its composition?
How is it prepared? Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of sulphate be detected?
What is the dose?
Compound pills of antimony—Give the Latin name.
What is the composition of this pill? For what is it used?
Antimonial powder—Give the Latin name.
What is its composition? What is the dose?
Wine of antimony—Give the Latin name.
How is it made? What is the dose?
Arsenic—Give the Latin name, symbol, and atomic weight.
Where is it found, and how is it obtained?
What combinations does it form with oxygen?
What combinations does it form with sulphur?
What are the tests for arsenic and its salts?
Arsenous acid—Give Latin name, formula in symbols, and molecular weight.
How is it made?
Chemically, is it regarded as an acid? What is true arsenous acid?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
What are the official antidotes to arsenical poisoning?
Solution of arsenous acid—Give Latin name.
What was the name of this solution in the U.S. Pharm. 1870?
Why was the name changed? How is it made?
How can its quality be tested? What is the dose?
Solution of potassium arsenite—What is the Latin name?
How is it made? Give rationale of the process.

Wherein does it differ from the British "liquor arsenicalis"?
How may its quality be tested? What is the dose?
Sodium arsenate—Give Latin name, formula in symbols, and molecular weight.
Arsenic iodide—Give Latin name, formula in symbols, and molecular weight.
What objection is there to this process? How otherwise may it be made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Solution of arsenic and mercuric iodide—Give the Latin name. How is it made?
How may the color of the solution, which has become dark upon standing, be restored? What is the dose?
Bismuth—Give the symbol and atomic weight.
Give description and specific gravity. Describe odor, taste, and chemical reaction.
How is it found? What are tests for salts of bismuth?
Bismuth citrate—What is its formula in symbols? Give its molecular weight.
How is it made? Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of nitrate be detected? For what is it used?
Bismuth and ammonium citrate—How is it made?
Why is the solution of this salt sometimes not perfectly transparent, and how may it be made so?
What is liquor bismuthi, and how is it made?
Bismuth and ammonium citrate—Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may impurity of nitrate be detected? What is the dose?
Bismuth subcarbonate—Give formula in symbols and molecular weight.
Why is such an elaborate process adopted for obtaining this salt?
Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Insoluble foreign substances; lead; copper; chloride; sulphate; silver; alkalies and alkaline earths; traces of ammonium; traces of antimony, arsenic, and tin; more than traces of arsenic. What is the dose?
Bismuth subnitrate—How is the separation of arsenic accomplished? Give rationale of the process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Carbonate; insoluble foreign salts. What is the dose?

CHAPTER XLVIII.

GOLD AND PLATINUM.

Au; 196.7. Pt; 194.8.

SALTS of these precious metals are official,—the gold salt as a substance in the materia medica, the platinum salt as a test-liquid: both are chlorides. Gold and platinum are both found native in the free state. Latin names for these metals are Aurum and Platinum.

Tests for Gold Salts.

1. If hydrogen sulphide be added to the solution of a gold salt, a dark brown, almost black, precipitate (auric sulphide) will be produced, soluble in ammonium sulphide.

2. If ferrous sulphate be added to a solution of a gold salt, metallic gold in the form of a fine precipitate will be produced: this may be fused into a button of gold by the use of the blow-pipe.

3. Stannous chloride if added to dilute solutions of gold salts produces a purple precipitate (purple of Cassius).

Tests for Platinum Salts.

1. If hydrogen sulphide or ammonium sulphide be added to a solution of platinic chloride, a brown precipitate of platinic sulphide will be produced, soluble in excess of ammonium sulphide.

2. If a solution of potassium chloride be added to a solution of platinic chloride acidulated with hydrochloric acid, a yellow precipitate (double chloride) will be formed.

Official Salts of Gold and Platinum.

Official Name.	Preparation.
Auri et Sodii Chloridum . .	Equal parts of dry auric chloride and sodium chloride.
Platini Chloridum	Test-solution of platinic chloride, 1 part of platinic chloride in 20 parts of distilled water.

Unofficial Preparations of Gold.

Auri Bromidum, $AuBr_3$. Gold Bromide.	By dissolving gold in a mixture of nitric and hydrobromic acids, concentrating, then crystallizing.
Auri Chloridum, $AuCl_3$. Gold Chloride.	By dissolving gold in nitrohydrochloric acid, concentrating carefully, then crystallizing.
Auri Iodidum, AuI_3. Gold Iodide.	By gradually adding a neutral solution of auric chloride to a solution of potassium iodide, then collecting and drying the precipitate.

AURI ET SODII CHLORIDUM. *U. S.* **Gold and Sodium Chloride.**

A mixture of equal parts, by weight, of dry Gold Chloride [$AuCl_3 = 302.81$] and Sodium Chloride [$NaCl = 58.37$].

Preparation.—It may be made by dissolving gold in nitrohydrochloric acid, evaporating the solution to dryness, weighing, and dissolving the dry mass in eight times its weight of distilled water. To this solution a weight of pure decrepitated common salt equalling that of the dry gold chloride is added, previously dissolved in four parts of water. The mixed solution is then evaporated to dryness, being constantly stirred with a glass rod.

Auri et Sodii Chloridum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
An orange-yellow powder, slightly deliquescent in damp air. When exposed to a red heat, it is decomposed and metallic gold is separated. A fragment of the compound imparts a persistent yellow color to a non-luminous flame. Its aqueous solution yields with silver nitrate a white precipitate insoluble in nitric acid.	Odorless; saline, metallic taste; slightly acid reaction.	Very soluble.	Cold, At least one-half should be soluble.

Quantitative Test.	Impurities.	Tests for Impurities.
If 0.5 Gm. of Gold and Sodium Chloride be dissolved in 50 C.c. of water, in a porcelain capsule, the solution acidulated with 5 C.c. of dilute sulphuric acid, and, after the addition of 1 Gm. of pure oxalic acid, heated for about 2 hours, on a water-bath, a precipitate of metallic gold will be obtained, which, when washed, dried, and ignited, should weigh not less than 0.15 Gm. (corresponding to at least 30 per cent. of metallic gold).	Free Acid.	On bringing a glass rod dipped into ammonia water close to a portion of the compound, no white fumes should make their appearance.
	Metallic Impurities.	The filtrate from the precipitated gold should not be affected by hydrogen sulphide T.S., nor, after being supersaturated with ammonia water, by ammonium sulphide T.S.

Uses.—This salt is used internally as an alterative. The dose is from one-twelfth to one-fourth of a grain (0.006 to 0.016 Gm.).

QUESTIONS ON CHAPTER XLVIII.

GOLD AND PLATINUM.

Gold—What is the Latin name? Give the symbol and atomic weight.
In what form is it official? How is it found?
What are the tests for gold salts?
Platinum—Give the symbol and atomic weight.
What salt of it is official, and for what is it used? How is it found?
What are the tests for platinum salts?
Gold and sodium chloride—What is the composition of this salt?
Give the formulas and equivalents of each of the ingredients.
How is it made?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may its quality be tested? How may free acid be detected?
What is the dose?

Official Chemical Substances, with their Preparations.

OFFICIAL NAME.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Acetanilidum.	$C_6H_5NH.-C_2H_3O$.	Antipyretic; gr. v–xv (0.3–0.9 Gm.).	
Acidum Aceticum.	$HC_2H_3O_2$.	Rubefacient.	**Diluted Acetic Acid,** Extract of Colchicum Root, Extract of Nux Vomica, Fluid Extract of Nux Vomica, Fluid Extract of Sanguinaria, Syrup of Ipecac, Tincture of Sanguinaria.
Acidum Aceticum Dilutum.		Refrigerant; m. x (0.6 C.c.).	Ammoniac Plaster with Mercury, Solution of Ammonium Acetate, Solution of Iron and Ammonium Acetate, Syrup of Garlic, Vinegar of Opium, Vinegar of Squill.
Acidum Aceticum Glaciale.	$HC_2H_3O_2$.	Solvent.	Solution of Ferric Acetate.
Acidum Arsenosum.	As_2O_3.	Alterative; gr. $\frac{1}{20}$ (0.003 Gm.).	**Solution** (with diluted HCl), Solution of Potassium Arsenite.
Acidum Benzoicum.	$HC_7H_5O_2$.	Stimulant; gr. x (0.6 Gm.).	Camphorated Tincture of Opium.
Acidum Boricum.	H_3BO_3.	Antiseptic; gr. v (0.3 Gm.).	Glycerite of Boroglycerin.
Acidum Carbolicum.	C_6H_5OH.	Irritant.	**Glycerite, Ointment.**
Acidum Carbolicum Crudum.		Disinfectant.	
Acidum Chromicum.	CrO_3.	Escharotic.	
Acidum Citricum.	$H_3C_6H_5O_7 + H_2O$.	Refrigerant; gr. v–xxx (0.3–1.9 Gm.).	**Syrup,** Bismuth Citrate, Citrated Caffeine, Effervescent Citrated Caffeine, Effervescent Lithium Citrate, Effervescent Magnesium Citrate, Effervescent Potassium Citrate, Iron and Quinine Citrate, Iron and Strychnine Citrate, Soluble Iron and Quinine Citrate, Solution of Ferric Citrate, Solution of Magnesium Citrate, Solution of Potassium Citrate.
Acidum Gallicum.	$HC_7H_5O_5 + H_2O$.	Astringent; gr. v–xv (0.3–0.9 Gm.).	
Acidum Hydrobromicum Dilutum.	HBr.	Hypnotic; f ʒij (7.4 C.c.).	
Acidum Hydrochloricum.	HCl.	Tonic, refrigerant; m. v–x (0.3–0.6 C.c.).	**Diluted Hydrochloric Acid, Nitrohydrochloric Acid, Diluted Nitrohydrochloric Acid,** Chlorine Water, Ferric Chloride, Moulded Silver Nitrate, Precipitated Sulphur, Purified Animal Charcoal, Resin of Podophyllum, Solution of Ferric Chloride, Solution of Zinc Chloride.
Acidum Hydrochloricum Dilutum.		Tonic, refrigerant; m. xv–xxx (0.9–1.8 C.c.).	Solution of Arsenous Acid.

Official Name.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Acidum Hydrocyanicum Dilutum.	HCN.	Sedative, anodyne; m. ij (0.1 C.c.).	
Acidum Hypophosphorosum Dilutum.	HPH_2O_2.	Tonic, refrigerant; m. x–xxx (0.6–1.8 C.c.).	**Syrupus Hypophosphitum.**
Acidum Lacticum.	$HC_3H_5O_3$.	Solvent.	Syrup of Calcium Lactophosphate.
Acidum Nitricum.	HNO_3.	Tonic, antiseptic; m. v (0.3 C.c.).	**Diluted Nitric Acid, Nitrohydrochloric Acid, Diluted Nitrohydrochloric Acid,** Ferric Chloride, Ointment of Mercuric Nitrate, Pyroxylin, Solution of Ferric Chloride, Solution of Ferric Nitrate, Solution of Ferric Subsulphate, Solution of Ferric Sulphate, Solution of Mercuric Nitrate, Solution of Zinc Chloride, Yellow Mercuric Iodide, Yellow Mercuric Subsulphate.
Acidum Nitricum Dilutum.		Tonic, antiseptic; m. xx (1.2 C.c.).	
Acidum Nitrohydrochloricum.		Cholagogue; m. iij (0.19 C.c.).	
Acidum Nitrohydrochloricum Dilutum.		Cholagogue; m. x (0.6 C.c.).	
Acidum Oleicum.	$HC_{18}H_{33}O_2$.	Vehicle, externally.	Oleate of Mercury, Oleate of Veratrine, Oleate of Zinc.
Acidum Phosphoricum.	H_3PO_4.	Tonic, refrigerant; m. v (0.3 C.c.).	**Diluted Phosphoric Acid,** Solution of Hydrogen Dioxide, Syrup of Calcium Lactophosphate, Syrup of Iron, Quinine, and Strychnine Phosphates.
Acidum Phosphoricum Dilutum.		Tonic, refrigerant; m. xx (1.2 C.c.).	
Acidum Salicylicum.	$HC_7H_5O_3$.	Antirheumatic; gr. x (0.6 Gm.).	
Acidum Stearicum.	$HC_{18}H_{35}O_2$.	In making glycerin suppositories.	Suppositories of Glycerin.
Acidum Sulphuricum.	H_2SO_4.	Tonic, refrigerant; m. i (0.06 C.c.).	**Aromatic Sulphuric Acid, Diluted Sulphuric Acid,** Ammoniated Glycyrrhizin, Diluted Hydrocyanic Acid, Ethereal Oil, Pyroxylin, Solution of Ferric Subsulphate, Solution of Ferric Sulphate, Spirit of Nitrous Ether, Sulphurous Acid, Yellow Mercuric Subsulphate.
Acidum Sulphuricum Aromaticum.		Tonic, astringent; m. x (0.6 C.c.).	Infusion of Cinchona.
Acidum Sulphuricum Dilutum.		Tonic, refrigerant; m. x (0.6 C.c.).	Granulated Ferrous Sulphate, Solution of Hydrogen Dioxide, Sulphurated Antimony.
Acidum Sulphurosum.	SO_2.	Antiferment; m. iij (0.18 C.c.).	
Acidum Tannicum.	$HC_{14}H_9O_9$.	Astringent; gr. iij (0.19 Gm.).	**Glycerite, Ointment, Troches,** Styptic Collodion.
Acidum Tartaricum.	$H_2C_4H_4O_6$.	Refrigerant; gr. x (0.6 Gm.).	Compound Effervescing Powder, Effervescent Citrated Caffeine, Iron and Ammonium Tartrate, Syrup of Hydriodic Acid.

OFFICIAL NAME.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Æther.	$(C_2H_5)_2O$.	Anæsthetic; m. xxx (1.8 C.c.).	**Spirit, Compound Spirit,** Collodion, Deodorized Opium, Tincture of Deodorized Opium, Ethereal Oil, Extract of Nux Vomica, Oleoresins, Phosphorated Oil, Pills of Ferrous Iodide, Pills of Phosphorus, Pyroxylin, Styptic Collodion.
Æther Aceticus.	$C_2H_5C_2H_3O_2$.	Stimulant, antispasmodic; m. xv (0.9 C.c.).	
Alcohol.	$C_2H_5,(OH)$.	Used as a solvent.	**Diluted Alcohol,** Fluid Extracts, Spirits, Tinctures, etc.
Alcohol Absolutum.	$C_2H_5,(OH)$.	" "	Spirit of Phosphorus.
Alcohol Deodoratum.	$C_2H_5,(OH)$.	" "	Aromatic Elixir, Compound Spirit of Orange, Spirit of Anise, Spirit of Lavender, Spirit of Lemon, Spirit of Nitrous Ether, Spirit of Orange.
Alcohol Dilutum.		" "	Fluid Extracts, Tinctures, etc.
Alumen.	$Al_2K_2(SO_4)_4 + 24H_2O$.	Astringent, emetic; gr. v–xxx (0.3–1.9 Gm.).	**Dried Alum,** Aluminum Hydrate.
Alumen Exsiccatum.	$Al_2K_2(SO_4)_4$.	Astringent, escharotic; gr. iij (0.2 Gm.).	
Alumini Hydras.	$Al_2(OH)_6$.	Astringent; gr. v (0.3 Gm.).	
Alumini Sulphas.	$Al_2(SO_4)_3.16H_2O$.	Astringent; gr. v (0.3 Gm.).	
Ammonii Benzoas.	$NH_4C_7H_5O_2$.	Stimulant; gr. v (0.3 Gm.).	
Ammonii Bromidum.	NH_4Br.	Nervine; gr. x (0.6 Gm.).	
Ammonii Carbonas.	$NH_4HCO_3.NH_4NH_2CO_2$.	Stimulant, irritant; gr. v (0.3 Gm.).	Aromatic Spirit of Ammonia, Solution of Ammonium Acetate.
Ammonii Chloridum.	NH_4Cl.	Expectorant; gr. x (0.6 Gm.).	**Troches.**
Ammonii Iodidum.	NH_4I.	Resolvent; gr. iij (0.2 Gm.).	
Ammonii Nitras.	NH_4NO_3.	In making Nitrous Oxide.	
Ammonii Valerianas.	$NH_4C_5H_9O_2$.	Nervine; gr. v. (0.3 Gm.).	
Amyl Nitris.	$C_5H_{11}NO_2$.	Anæsthetic; m. iij (0.2 C.c.).	
Antimonii et Potassii Tartras.	$2K(SbO)C_4H_4O_6 + H_2O$.	Expectorant; gr. $\frac{1}{10}$–$\frac{1}{4}$ (0.006–0.016 Gm.). Emetic; gr. i (0.06 Gm.).	Compound Syrup of Squill, Wine of Antimony.
Antimonii Oxidum.	Sb_2O_3.	Alterative, sedative; gr. iij (0.2 Gm.).	Antimonial Powder.
Antimonii Sulphidum.	Sb_2S_3.	Alterative; gr. iij (0.2 Gm.).	**Purified Antimony Sulphide** (with Ammonia Water).
Antimonii Sulphidum Purificatum.	Sb_2S_3.	Alterative; gr. iij (0.2 Gm.).	Sulphurated Antimony.
Antimonium Sulphuratum.	Sb_2S_3.	Alterative, diaphoretic; gr. i (0.06 Gm.).	Compound Pills of Antimony.
Apomorphinæ Hydrochloras.	$C_{17}H_{17}NO_2$-HCl.	Emetic; gr. $\frac{1}{4}$ (0.016 Gm.).	

OFFICIAL NAME.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Aqua.	H_2O.		
Aqua Ammoniæ.	NH_3.	Stimulant, antacid; m. v (0.3 C.c.).	**Liniment**, Ammoniated Glycyrrhizin, Ammoniated Mercury, Aromatic Spirit of Ammonia, Bismuth and Ammonium Citrate, Iron and Ammonium Citrate, Ferric Hydrate, Fluid Extract of Glycyrrhiza, Fluid Extract of Senega, Purified Antimony Sulphide, Pure Extract of Glycyrrhiza, Solution of Ferric Acetate, Solution of Ferric Citrate, Solution of Ferric Nitrate, Iron and Ammonium Tartrate, Iron and Potassium Tartrate, Soluble Iron and Quinine Citrate, Syrup of Senega, Washed Sulphur.
Aqua Ammoniæ Fortior.	NH_3.		**Spirit.**
Aqua Chlori.		Stimulant, antiseptic; f℥i (3.7 C.c.).	
Aqua Destillata.	H_2O.		
Aqua Hydrogenii Dioxidi.	H_2O_2.		
Argenti Cyanidum.	AgCN.	Externally.	Diluted Hydrocyanic Acid.
Argenti Iodidum.	AgI.	Nervine, antisyphilitic; gr. i (0.06 Gm.).	
Argenti Nitras.	$AgNO_3$.	Stimulant, astringent; gr. $\frac{1}{4}$ (0.016 Gm.).	**Diluted Silver Nitrate** (with KNO_3), **Moulded Silver Nitrate** (with HCl).
Argenti Nitras Dilutus.		Caustic.	
Argenti Nitras Fusus.		Caustic.	
Argenti Oxidum.	Ag_2O.	Tonic; gr. $\frac{1}{2}$–ij (0.03–0.13 Gm.).	
Arseni Iodidum.	AsI_3.	Alterative; gr. $\frac{1}{8}$ (0.008 Gm.).	Solution of Arsenic and Mercuric Iodide.
Atropina.	$C_{17}H_{23}NO_3$.	Sedative; gr. $\frac{1}{120}$–$\frac{1}{160}$ (0.0005–0.0004 Gm.).	
Atropinæ Sulphas.	$(C_{17}H_{23}NO_3)_2$-H_2SO_4.	Mydriatic; gr. $\frac{1}{100}$ (0.0006 Gm.).	
Auri et Sodii Chloridum.	$AuCl_3$ and NaCl.	Alterative; gr. $\frac{1}{16}$ (0.004 Gm.).	
Barii Dioxidum.	BaO_2.		Solution of Hydrogen Dioxide.
Benzinum.	C_5H_{12},C_6H_{14}.	Solvent.	Mustard Paper, Tincture of Lactucarium.
Bismuthi Citras.	$BiC_6H_5O_7$.	Nervine; gr. iij (0.19 Gm.).	Bismuth and Ammonium Citrate.
Bismuthi et Ammonii Citras.		Nervine; gr. ij (0.13 Gm.).	
Bismuthi Subcarbonas.		Astringent, antispasmodic; gr. viij (0.5 Gm.).	
Bismuthi Subnitras.		Astringent, antispasmodic; gr. viij (0.5 Gm.).	Bismuth Citrate.
Bromum.	Br.	Alterative, stimulant; gr. $\frac{1}{2}$ (0.03 Gm.).	

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Caffeina.	$C_8H_{10}N_4O_2 + H_2O$.	Stimulant; gr. iij–x (0.19–0.6 Gm.).	**Citrated Caffeine, Effervescent Citrated Caffeine.**
Caffeina Citrata.		Stimulant; gr. iij–x (0.19–0.6 Gm.).	
Caffeina Citrata Effervescens.		Stimulant; gr. lx (3.9 Gm.).	
Calcii Bromidum.	$CaBr_2$.	Stimulant, nervine; gr. xxx (1.9 Gm.).	
Calcii Carbonas Præcipitatus.	$CaCO_3$.	Antacid, astringent; gr. x–xl (0.6–2.5 Gm.).	Compound Powder of Morphine, Syrup of Calcium Lactophosphate.
Calcii Chloridum.	$CaCl_2$.	Alterative; gr. x (0.6 Gm.).	Solution of Chlorinated Soda.
Calcii Hypophosphis.	$Ca(PH_2O_2)_2$.	Alterative; gr. x (0.6 Gm.).	Syrup of Hypophosphites.
Calcii Phosphas Præcipitatus.	$Ca_3(PO_4)_2$.	In making medicated waters.	Antimonial Powder, used as a clarifying agent and absorbent in medicated waters, syrups, etc.
Calcii Sulphas Exsiccatus.	$CaSO_4$.	For surgical purposes.	Sulphurated Lime.
Calx.	CaO.	Escharotic.	**Solution, Syrup,** Potassa with Lime, Precipitated Sulphur, Solution of Potassa, Solution of Soda.
Calx Chlorata.		Disinfectant.	Solution of Chlorinated Soda.
Calx Sulphurata.	CaS and $CaSO_4$.	Depilatory.	
Camphora Monobromata.	$C_{10}H_{15}BrO$.	Nervous sedative; gr. v (0.3 Gm.).	
Carbonei Disulphidum.	CS_2.	Solvent.	Mustard Paper.
Cerii Oxalas.	$Ce_2(C_2O_4)_3 + 9H_2O$.	Sedative, tonic, gr. ij (0.13 Gm.).	
Chloral.	$C_2HCl_3O + H_2O$.	Sedative; gr. x (0.6 Gm.)	
Chloroformum.	$CHCl_3$.	Anæsthetic; f℥i (3.7 C.c.).	**Emulsion, Liniment, Spirit, Water,** Cantharidal Collodion, Pills of Phosphorus.
Cinchonidinæ Sulphas.	$(C_{19}H_{22}N_2O)_2 H_2SO_4 + 3H_2O$.	Tonic, febrifuge; gr. i–xxx (0.06–1.9 Gm.).	
Cinchonina.	$C_{19}H_{22}N_2O$.	Tonic; gr. i–xxx (0.06–1.9 Gm.).	
Cinchoninæ Sulphas.	$(C_{19}H_{22}N_2O)_2 H_2SO_4 + 2H_2O$.	Tonic; gr. i–xxx (0.06–1.9 Gm.).	
Cocainæ Hydrochloras.	$C_{17}H_{21}NO_4\text{-}HCl$.	Local anæsthetic; gr. ¼–i (0.016–0.06 Gm.).	
Codeina.	$C_{18}H_{21}NO_3 + H_2O$.	Narcotic; gr. ¼–i (0.016–0.06 Gm.).	
Creosotum.		Antiferment; m. i (0.06 C.c.).	**Water.**
Creta Præparata.	$CaCO_3$.	Antacid; gr. x–lx (0.6–3.9 Gm.).	**Compound Powder, Troches, Mercury with Chalk.**
Cupri Sulphas.	$CuSO_4 + 5H_2O$.	Tonic; escharotic; gr. ¼ (0.016 Gm.).	

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Elaterinum.	$C_{20}H_{28}O_5$.	Hydragogue cathartic; gr. $\frac{1}{16}$ (0.004 Gm.).	**Trituration.**
Eucalyptol.	$C_{10}H_{18}O$.	Antiseptic, stimulant; m. v–x (0.3–0.6 C.c.).	
Ferri Carbonas Saccharatus.		Tonic; gr. v–xx (0.3–1.3 Gm.)	
Ferri Chloridum.	$Fe_2Cl_6 + 12H_2O$.	Hæmostatic.	
Ferri Citras.		Mild tonic; gr. v–xx (0.3–1.3 Gm.).	Iron and Quinine Citrate, Soluble Ferric Phosphate, Soluble Ferric Pyrophosphate, Soluble Iron and Quinine Citrate.
Ferri et Ammonii Citras.		Tonic; gr. v (0.3 Gm.).	Iron and Strychnine Citrate, Wine of Ferric Citrate.
Ferri et Ammonii Sulphas.	$Fe_2(NH_4)_2(SO_4)_4 + 24H_2O$.	Styptic; gr. v (0.3 Gm.).	
Ferri et Ammonii Tartras.		Tonic; gr. x (0.6 Gm.).	
Ferri et Potassii Tartras.		Tonic; gr. x (0.6 Gm.).	
Ferri et Quininæ Citras.		Tonic; gr. v (0.3 Gm.).	
Ferri et Quininæ Citras Solubilis.		Tonic; gr. v (0.3 Gm.).	Bitter Wine of Iron.
Ferri et Strychninæ Citras.		Tonic; gr. iv (0.25 Gm.).	
Ferri Hypophosphis.	$Fe_2(PH_2O_2)_6$.	Tonic; gr. v (0.3 Gm.).	
Ferri Iodidum Saccharatum.		Tonic, alterative; gr. iij (0.2 Gm.).	
Ferri Lactas.	$Fe(C_3H_5O_3)_2 + 3H_2O$.	Tonic; gr. ij (0.13 Gm.).	Syrup of Hypophosphites with Iron.
Ferri Oxidum Hydratum.	$Fe_2(OH)_6$.	Antidote to Arsenic.	Iron Plaster, Troches of Iron.
Ferri Oxidum Hydratum cum Magnesia.		Antidote to Arsenic.	
Ferri Phosphas Solubilis.		Tonic; gr. v (0.3 Gm.).	Syrup of Iron, Quinine, Strychnine, and Phosphates.
Ferri Pyrophosphas Solubilis.		Tonic; gr. ij–v (0.13–0.3 Gm.).	
Ferri Sulphas.	$FeSO_4 + 7H_2O$.	Astringent, tonic; gr. ij (0.13 Gm.).	**Dried Ferrous Sulphate, Granulated Ferrous Sulphate,** Compound Iron Mixture, Mass of Ferrous Carbonate, Pills of Ferrous Carbonate, Saccharated Ferrous Carbonate, Solution of Ferric Subsulphate, Solution of Ferric Sulphate.
Ferri Sulphas Exsiccatus.	$2FeSO_4 + 3H_2O$.	Astringent, tonic; gr. i (0.06 Gm.).	Pills of Aloes and Iron.
Ferri Sulphas Granulatus.	$FeSO_4 + 7H_2O$.	Astringent, tonic; gr. ij (0.13 Gm.).	
Ferri Valerianas.		Tonic, nervine; gr. i (0.06 Gm.).	
Ferrum.	Fe.		Ferric Chloride, Saccharated Ferrous Iodide, Solution of Ferric Chloride, Syrup of Ferrous Iodide.

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Ferrum Reductum.	Fe.	Tonic; gr. v (0.3 Gm.).	Pills of Ferrous Iodide, Saccharated Ferrous Iodide.
Glycerinum.	$C_3H_5(OH)_3$.	Solvent, and used externally.	**Suppositories**, Extracts, Fluid Extracts, Glycerites, Syrups, Tinctures, etc.
Glycyrrhizinum Ammoniatum.		Expectorant; gr. x (0.6 Gm.).	
Hydrargyri Chloridum Corrosivum.	$HgCl_2$.	Antisyphilitic, alterative; gr. $\frac{1}{12}$ (0.006 Gm.).	Ammoniated Mercury, Red Mercuric Iodide, Yellow Mercuric Oxide.
Hydrargyri Chloridum Mite.	Hg_2Cl_2.	Purgative; gr. v–x (0.3–0.6 Gm.).	Compound Cathartic Pills, Compound Pills of Antimony.
Hydrargyri Cyanidum.	$Hg(CN)_2$.	Alterative; gr. $\frac{1}{16}$ (0.004 Gm.).	
Hydrargyri Iodidum Flavum.	Hg_2I_2.	Alterative, antisyphilitic; gr. i (0.06 Gm.).	
Hydrargyri Iodidum Rubrum.	HgI_2.	Alterative, antisyphilitic; gr. $\frac{1}{16}$ (0.004 Gm.).	Solution of Arsenic and Mercuric Iodide.
Hydrargyri Oxidum Flavum.	HgO.	Externally.	**Ointment, Oleate.**
Hydrargyri Oxidum Rubrum.	HgO.	Externally.	**Ointment**, Solution of Mercuric Nitrate.
Hydrargyri Subsulphas Flavus.	$Hg(HgO)_2SO_4$.	Alterative; gr. $\frac{1}{4}$ (0.016 Gm.).	
Hydrargyrum.	Hg.		**Mass, Mercury with Chalk, Ointment, Plaster**, Ammoniac Plaster with Mercury, Ointment of Mercuric Nitrate, Yellow Mercuric Subsulphate, Yellow Mercurous Iodide.
Hydrargyrum Ammoniatum.	NH_2HgCl.	Used externally.	**Ointment.**
Hydrargyrum cum Creta.		Alterative; gr. v (0.3 Gm.).	
Hydrastininæ Hydrochloras.	$C_{11}H_{11}NO_2$-HCl.	Alterative; gr. $\frac{1}{4}$–$\frac{1}{2}$ (0.016–0.03 Gm.).	
Hyoscinæ Hydrobromas.	$C_{17}H_{21}NO_4H$-Br + $3H_2O$.	Sedative; gr. $\frac{1}{80}$ (0.0008 Gm.).	
Hyoscyaminæ Hydrobromas.	$C_{17}H_{23}NO_3$-HBr.	Sedative; gr. $\frac{1}{60}$ (0.001 Gm.).	
Hyoscyaminæ Sulphas.	$(C_{17}H_{23}NO_3)_2$-H_2SO_4.	Sedative; gr. $\frac{1}{60}$ (0.001 Gm.).	
Iodoformum.	CHI_3.	Anæsthetic, antiseptic; gr. i (0.06 Gm.).	**Ointment.**
Iodum.	I.	Alterative, stimulant; gr. $\frac{1}{4}$ (0.016 Gm.).	**Compound Solution, Ointment, Tincture**, Pills of Ferrous Iodide, Saccharated Ferrous Iodide, Sulphur Iodide, Syrup of Ferrous Iodide.
Liquor Acidi Arsenosi.		Alterative; m. iv (0.2 C.c.).	
Liquor Ammonii Acetatis.	$NH_4C_2H_3O_2$.	Diaphoretic; f℥iij (11.1 C.c.).	Solution of Iron and Ammonium Acetate.
Liquor Arseni et Hydrargyri Iodidi.		Alterative; m. v (0.3 C.c.).	
Liquor Calcis.	$Ca(OH)_2$.	Antacid; f℥ij (60 C.c.).	**Lime Liniment.**

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Liquor Ferri Acetatis.	$Fe_2(C_2H_3O_2)_6$.	Tonic; m. v (0.3 C.c.).	
Liquor Ferri Chloridi.	Fe_2Cl_6.	Styptic.	Tincture of Ferric Chloride.
Liquor Ferri Citratis.		Tonic; m. x (0.6 C.c.)	Ferric Citrate, Iron and Ammonium Citrate.
Liquor Ferri Nitratis.	$Fe_2(NO_3)_6$.	Tonic, astringent; m. v (0.3 C.c.).	
Liquor Ferri Subsulphatis.		Styptic; m. iij (0.18 C.c.).	
Liquor Ferri Tersulphatis.	$Fe_2(SO_4)_3$.	Styptic; m. iij (0.18 C.c.).	Ferric Hydrate, Ferric Hydrate with Magnesia, Iron and Ammonium Tartrate, Iron and Potassium Tartrate, Solution of Ferric Acetate, Solution of Ferric Citrate, Solution of Ferric Nitrate.
Liquor Hydrargyri Nitratis.	$Hg(NO_3)_2$.	Escharotic.	
Liquor Iodi Compositus.		Alterative; m. v (0.3 C.c.).	
Liquor Magnesii Citratis.		Cathartic; f℥xij (355 C.c.).	
Liquor Plumbi Subacetatis.	$Pb_2O(C_2H_3O_2)_2$.	Externally.	**Cerate, Diluted Solution.**
Liquor Plumbi Subacetatis Dilutus.		Externally.	
Liquor Potassæ.	KOH.	Antacid, antilithic; m. x (0.6 C.c.).	
Liquor Potassii Arsenitis.		Alterative; m. v (0.3 C.c.).	
Liquor Potassii Citratis.	$K_3C_6H_5O_7$.	Refrigerant, diaphoretic; fℨi (3.7 C.c.).	
Liquor Sodæ.	NaOH.	Antacid, antilithic; m. x (0.6 C.c.).	Sulphurated Antimony.
Liquor Sodæ Chloratæ.		Stimulant, antiseptic; m. xxx (1.8 C.c.).	
Liquor Sodii Arsenatis.		Alterative; m. v (0.2 C.c.).	
Liquor Sodii Silicatis.		Used externally.	
Liquor Zinci Chloridi.	$ZnCl_2$.	Disinfectant.	
Lithii Benzoas.	$LiC_7H_5O_2$.	Diuretic; gr. xv (0.9 Gm.).	
Lithii Bromidum.	LiBr.	Nervine; gr. xv (0.9 Gm.).	
Lithii Carbonas.	Li_2CO_3.	Diuretic; gr. v (0.3 Gm.).	Effervescent Lithium Citrate.
Lithii Citras.	$Li_3C_6H_5O_7$.	Diuretic; gr. xv (0.9 Gm.).	
Lithii Citras Effervescens.		Diuretic; gr. lx (3.9 Gm.).	
Lithii Salicylas.	$LiC_7H_5O_3$.	Antirheumatic; gr. xxv (1.6 Gm.).	
Magnesia.	MgO.	Antacid, laxative; gr. xx (1.3 Gm.).	Ferric Hydrate with Magnesia, Compound Powder of Rhubarb, Mass of Copaiba.
Magnesia Ponderosa.	MgO.	Antacid, laxative; gr. xx (1.3 Gm.).	
Magnesii Carbonas.	$(MgCO_3)_4.Mg(OH)_2 + 5H_2O$.	Antacid; gr. lx (3.9 Gm.).	Solution of Magnesium Citrate, Effervescent Magnesium Citrate.

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Magnesii Citras Effervescens.		Cathartic; gr. lx (3.9 Gm.).	
Magnesii Sulphas.	$MgSO_4 + 7H_2O$.	Cathartic; ℥i (31 Gm.).	Compound Infusion of Senna.
Mangani Dioxidum.	MnO_2.	Tonic, alterative; gr. v (0.3 Gm.).	Chlorine Water.
Mangani Sulphas.	$MnSO_4 + 4H_2O$.	Cholagogue, tonic; gr. x (0.6 Gm.).	
Massa Ferri Carbonatis.		Tonic; gr. xv (0.9 Gm.).	
Massa Hydrargyri.		Purgative; gr. x (0.6 Gm.).	
Menthol.	$C_{10}H_{19}OH$.	Stimulant.	
Methyl Salicylas.	$CH_3C_7H_5O_3$.	Antirheumatic; m. v (0.3 C.c.).	
Morphina.	$C_{17}H_{19}NO_3 + H_2O$.	Sedative; gr. ⅛ (0.008 Gm.).	
Morphinæ Acetas.	$C_{17}H_{19}NO_3C_2H_4O_2 + 3H_2O$.	Sedative; gr. ⅛ (0.008 Gm.).	
Morphinæ Hydrochloras.	$C_{17}H_{19}NO_3HCl + 3H_2O$.	Sedative; gr. ⅛ (0.008 Gm.).	
Morphinæ Sulphas.	$(C_{17}H_{19}NO_3)_2H_2SO_4 + 5H_2O$.	Sedative; gr. ⅛ (0.008 Gm.).	**Compound Powder,** Troches of Morphine and Ipecac.
Naphtalinum.	$C_{10}H_8$.	Insecticide.	
Naphtol.	$C_{10}H_7OH$.	Antiseptic; gr. iij (0.2 Gm.).	
Oleum Æthereum.		Anodyne; m. i (0.06 C.c.).	Compound Spirit of Ether.
Paraldehydum.	$C_6H_{12}O_3$.	Sedative; m. xxx (1.8 C.c.).	
Petrolatum Liquidum.		Externally.	
Petrolatum Molle.		Externally.	
Petrolatum Spissum.		Externally.	
Phosphorus.	P.	Aphrodisiac, stimulant; gr. 1/100 (0.0006 Gm.).	**Oil, Pill, Spirit.**
Physostigminæ Salicylas.	$C_{15}H_{21}N_3O_2C_7H_6O_3$.	Sedative; gr. 1/80 (0.0008 Gm.).	
Physostigminæ Sulphas.	$(C_{15}H_{21}N_3O_2)_2H_2SO_4$.	Sedative; gr. 1/80 (0.0008 Gm.).	
Picrotoxinum.	$C_{30}H_{34}O_{13}$.	Sedative; gr. 1/60 (0.001 Gm.).	
Pilocarpinæ Hydrochloras.	$C_{11}H_{16}N_2O_2HCl$	Diaphoretic; gr. ⅛ (0.008 Gm.).	
Piperinum.	$C_{17}H_{19}NO_3$.	Stimulant; gr. v (0.3 Gm.).	
Plumbi Acetas.	$Pb(C_2H_3O_2)_2 + 3H_2O$.	Astringent, sedative; gr. ij (0.13 Gm.).	Solution of Lead Subacetate.
Plumbi Carbonas.	$(PbCO_3)_2Pb(OH)_2$.	Externally.	**Ointment.**
Plumbi Iodidum.	PbI_2.	Externally.	**Ointment.**
Plumbi Nitras.	$Pb(NO_3)_2$.	Externally.	
Plumbi Oxidum.	PbO.	Externally.	Lead Plaster, Solution of Lead Subacetate.
Potassa.	KOH.	Escharotic.	**Potassa with Lime, Solution,** Soft Soap.
Potassa cum Calce.		Escharotic.	
Potassa Sulphurata.		Used in skin diseases; gr. iij (0.2 Gm.).	

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Potassii Acetas.	$KC_2H_3O_2$.	Diuretic; gr. xx (1.3 Gm.).	
Potassii Bicarbonas.	$KHCO_3$.	Antacid, diuretic; gr. xv (0.9 Gm.).	Effervescent Potassium Citrate, Solution of Magnesium Citrate, Solution of Potassa, Solution of Potassium Arsenite, Solution of Potassium Citrate.
Potassii Bichromas.	$K_2Cr_2O_7$.	Escharotic.	
Potassii Bitartras.	$KHC_4H_4O_6$.	Purgative; ʒi–ʒiv (3.9–15.5 Gm.).	Compound Powder of Jalap, Iron and Potassium Tartrate.
Potassii Bromidum.	KBr.	Nervine; gr. xx (1.3 Gm.).	
Potassii Carbonas.	K_2CO_3.	Antacid, diuretic; gr. xv (0.9 Gm.).	Compound Iron Mixture, Pills of Ferrous Carbonate, Spirit of Nitrous Ether, Sulphurated Potassa, Syrup of Rhubarb.
Potassii Chloras.	$KClO_3$.	Alterative; gr. xv (0.9 Gm.).	**Troches.**
Potassii Citras.	$K_3C_6H_5O_7 + H_2O$.	Refrigerant; gr. xx (1.3 Gm.).	Syrup of Hypophosphites with Iron.
Potassii Citras Effervescens.		Refrigerant; gr. lx (3.9 Gm.).	
Potassii Cyanidum.	KCN.	Sedative; gr. $\frac{1}{12}$ (0.005 Gm.).	
Potassii et Sodii Tartras.	$KNaC_4H_4O_6 + 4H_2O$.	Purgative; ʒiv (15.5 Gm.).	Compound Effervescing Powder.
Potassii Ferrocyanidum.	$K_4Fe(CN)_6 + 3H_2O$.	Sedative; gr. x (0.6 Gm.).	Diluted Hydrocyanic Acid.
Potassii Hypophosphis.	KPH_2O_2.	Alterative; gr. xv (0.9 Gm).	Syrup of Hydriodic Acid, Syrup of Hypophosphites.
Potassii Iodidum.	KI.	Alterative; gr. v (0.3 Gm.).	**Ointment**, Compound Solution of Iodine, Iodine Ointment, Red Mercuric Iodide, Syrup of Hydriodic Acid, Yellow Mercurous Iodide.
Potassii Nitras.	KNO_3.	Diuretic; gr. x (0.6 Gm.).	**Paper**, Diluted Silver Nitrate.
Potassii Permanganas.	$KMnO_4$.	Disinfectant, emmenagogue; gr. i (0.06 Gm.).	
Potassii Sulphas.	K_2SO_4.	Purgative; gr. lx (3.9 Gm.).	
Pyrogallol.	$C_6H_3(OH)_3$.	Externally.	
Pyroxylinum.			**Collodion.**
Quinidinæ Sulphas.	$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 2H_2O$.	Tonic; gr. v (0.3 Gm.).	
Quinina.	$C_{20}H_{24}N_2O_2 + 3H_2O$.	Tonic; gr. v (0.3 Gm.).	Iron and Quinine Citrate, Soluble Iron and Quinine Citrate.
Quininæ Bisulphas.	$C_{20}H_{24}N_2O_2.H_2SO_4 + 7H_2O$.	Tonic; gr. v (0.3 Gm.).	
Quininæ Hydrobromas.	$C_{20}H_{24}N_2O_2.HBr + H_2O$.	Tonic; gr. v (0.3 Gm.).	
Quininæ Hydrochloras.	$C_{20}H_{24}N_2O_2.HCl + 2H_2O$.	Tonic; gr. v (0.3 Gm.).	
Quininæ Sulphas.	$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 7H_2O$.	Tonic; gr. v (0.3 Gm.).	Syrup of Iron, Quinine, and Strychnine Phosphates.
Quininæ Valerianas.	$C_{20}H_{24}N_2O_2.C_5H_{10}O_2 + H_2O$.	Tonic; gr. ij (0.13 Gm.).	
Resorcinum.	$C_6H_4(OH)_2$.	Antipyretic; gr. ij (0.13 Gm.).	

OFFICIAL NAME.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Saccharum.	$C_{12}H_{22}O_{11}$.		**Syrup, Syrups, Troches,** etc.
Saccharum Lactis.	$C_{12}H_{22}O_{11} + H_2O$.		Deodorized Opium, Extract of Nux Vomica, Extract of Opium, Powder of Ipecac and Opium, Saccharated Ferrous Iodide, Saccharated Pepsin, Trituration of Elaterin.
Salicinum.	$C_{13}H_{18}O_7$.	Tonic; gr. x (0.6 Gm.).	
Salol.	$C_6H_5C_7H_5O_3$.	Antipyretic; gr. xv–xxx (0.9–1.8 Gm.).	
Santoninum.	$C_{15}H_{18}O_3$.	Anthelmintic; gr. ij (0.13 Gm.).	**Troches.**
Sapo.		Antacid; gr. x (0.6 Gm.).	**Liniment, Plaster,** Compound Extract of Colocynth, Pills of Aloes, Pills of Aloes and Asafetida, Pills of Asafetida, Pills of Opium, Pills of Rhubarb.
Sapo Mollis.		Externally.	**Liniment.**
Soda.	NaOH.	Escharotic.	**Solution,** Yellow Mercuric Oxide.
Sodii Acetas.	$NaC_2H_3O_2 + 3H_2O$.	Diuretic; gr. xx (1.3 Gm.).	
Sodii Arsenas.	$Na_2HAsO_4 + 7H_2O$.	Alterative; gr. $\frac{1}{12}$ (0.005 Gm.).	**Solution.**
Sodii Benzoas.	$NaC_7H_5O_2$.	Antirheumatic; gr. lx (3.9 Gm.).	
Sodii Bicarbonas.	$NaHCO_3$.	Antacid; gr. xv (0.9 Gm.)	**Troches,** Compound Effervescing Powder, Effervescent Citrated Caffeine, Effervescent Lithium Citrate, Effervescent Magnesium Citrate, Mixture of Rhubarb and Soda, Saccharated Ferrous Carbonate.
Sodii Bisulphis.	$NaHSO_3$.	Antiseptic; gr. v (0.3 Gm.).	
Sodii Boras.	$Na_2Br_4O_7 + 10H_2O$.	Refrigerant, diuretic; gr. xv (0.9 Gm.).	Ointment of Rose Water.
Sodii Bromidum.	NaBr.	Nervine; gr. xxx (1.8 Gm.).	
Sodii Carbonas.	$Na_2CO_3 + 10H_2O$.	Antacid; gr. x (0.6 Gm.).	**Dried Carbonate,** Aluminum Hydrate, Mass of Ferrous Carbonate, Solution of Chlorinated Soda, Solution of Soda, Spirit of Nitrous Ether, Suppositories of Glycerin.
Sodii Carbonas Exsiccatus.		Antacid; gr. v (0.3 Gm.).	
Sodii Chloras.	$NaClO_3$.	Alterative; gr. x (0.6 Gm.).	
Sodii Chloridum.	NaCl.	Tonic; gr. xx (1.3 Gm.).	
Sodii Hypophosphis.	$NaH_2PO_2 + H_2O$.	Nervine, tonic; gr. v (0.3 Gm.).	Syrup of Hypophosphites.
Sodii Hyposulphis.	$Na_2S_2O_3 + 5H_2O$.	Alterative; gr. x (0.6 Gm.).	Ointment of Potassium Iodide.
Sodii Iodidum.	NaI.	Alterative; gr. xv (0.9 Gm.).	
Sodii Nitras.	$NaNO_3$.	Diuretic; gr. xv (0.9 Gm.).	
Sodii Nitris.	$NaNO_2$.		Spirit of Nitrous Ether.

Official Name.	Chemical Composition.	Uses and Dose.	Official Preparations in heavy type; those in which the Substance is used, in Roman type.
Sodii Phosphas.	$Na_2HPO_4 + 12H_2O$.	Purgative; ℥i (31 Gm.).	**Soluble Ferric Phosphate.**
Sodii Pyrophosphas.	$Na_4P_2O_7 + 10H_2O$.	Purgative; gr. x (0.6 Gm.).	
Sodii Salicylas.	$NaC_7H_5O_3$.	Stimulant; gr. xxx (1.8 Gm.).	
Sodii Sulphas.	$Na_2SO_4 + 10H_2O$.	Cathartic; ℥ij–℥iv (7.7–15.5 Gm.).	
Sodii Sulphis.	$Na_2SO_3 + 7H_2O$.	Antiferment; gr. x (0.6 Gm.).	
Sodii Sulphocarbolas.	$NaSO_3C_6H_4\text{-}(OH) + 2H_2O$.	Antiferment; gr. xx (1.3 Gm.).	
Sparteinæ Sulphas.	$C_{15}H_{26}N_2H_2\text{-}SO_4 + 4H_2O$.	Cardiac stimulant; gr. ⅙–½ (0.01–0.03 Gm.).	
Strontii Bromidum.	$SrBr_2 + 6H_2O$.	Nervine; gr. xx (1.3 Gm.).	
Strontii Iodidum.	$SrI_2 + 6H_2O$.	Alterative; gr. v (0.3 Gm.).	
Strontii Lactas.	$Sr(C_3H_5O_3)_2 + 3H_2O$.	Antirheumatic; gr. x (0.6 Gm.).	
Strychnina.	$C_{21}H_{22}N_2O_2$.	Tonic; gr. $\frac{1}{60}$ (0.001 Gm.).	Iron and Strychnine Citrate, Syrup of Iron, Quinine and Strychnine Phosphates.
Strychninæ Sulphas.	$(C_{21}H_{22}N_2O_2)_2 H_2SO_4 + 5H_2O$.	Tonic; gr. $\frac{1}{60}$ (0.001 Gm.).	
Sulphuris Iodidum.		Externally.	
Sulphur Lotum.	S.	Diaphoretic, resolvent; ʒi (3.9 Gm.).	**Ointment,** Compound Powder of Glycyrrhiza, Sulphur Iodide.
Sulphur Præcipitatum.	S.	Diaphoretic, resolvent; ʒi (3.9 Gm.).	
Sulphur Sublimatum.	S.	Diaphoretic, resolvent; ʒi (3.9 Gm.).	Precipitated Sulphur, Sulphurated Potassa, Washed Sulphur.
Terebenum.	$C_{10}H_{16}$.	Expectorant: m. xx (1.2 C.c.).	
Terpini Hydras.	$C_{10}H_{18}(OH)_2 + H_2O$.	Expectorant; gr. ii (0.13 Gm.).	
Thymol.	$C_{10}H_{14}O$.	Antiseptic.	
Veratrina.		Externally.	**Ointment, Oleate.**
Zinci Acetas.	$Zn(C_2H_3O_2)_2 + 2H_2O$.	Externally.	
Zinci Bromidum.	$ZnBr_2$.	Nervine; gr. v (0.3 Gm.).	
Zinci Carbonas Præcipitatus.		Externally.	Solution of Zinc Chloride.
Zinci Chloridum.	$ZnCl_2$.	Escharotic.	
Zinci Iodidum.	ZnI_2.	Externally.	
Zinci Oxidum.	ZnO.	Externally.	**Ointment, Oleate.**
Zinci Phosphidum.	Zn_3P_2.	Aphrodisiac; gr. ⅛ (0.008 Gm.).	
Zinci Sulphas.	$ZnSO_4 + 7H_2O$.	Astringent; gr. ij (0.13 Gm.).	
Zinci Valerianas.	$Zn(C_5H_9O_2)_2 + 2H_2O$.	Antispasmodic; gr. i (0.06 Gm.).	
Zincum.	Zn.		Solution of Zinc Chloride.

PART IV.

ORGANIC SUBSTANCES.

INTRODUCTORY.

THE view formerly held by chemists, that vegetable and animal substances owed their peculiar chemical and physical properties exclusively to the mysterious action of life, was seriously affected by the labors of such chemists as Wöhler, in 1828, and Kolbe and Frankland, in 1847, who succeeded in producing synthetically a number of compounds from mineral substances. These so-called artificial bodies were proved to be identical in chemical composition and physical properties with those obtained from nature, and the subsequent discovery of many others has necessitated a change in the definition of the term *organic chemistry*. This no longer means the study of substances produced through living organisms, but, as all organic bodies have been found upon analysis to contain carbon (generally associated with hydrogen, and often with oxygen and nitrogen), the following modern definition must be accepted: *Organic chemistry is the science which treats of the carbon compounds.*

The plan of this work will not admit of the acceptance of the latest systems of classification which have been advanced, for, notwithstanding the ingenious skill which is clearly perceptible in many of the groupings, they are not well adapted for the study of the carbon compounds from a pharmaceutical point of view. The groups which are characterized in modern organic chemistry as alcohols, ethers, compound ethers, aldehyds, ketones, amines, and amides, necessarily bring together many substances used in the materia medica which possess few pharmaceutical or medical analogies. For instance, glycerin, mannit, and carbolic acid are properly regarded as alcohols, and they would have to be grouped together, notwithstanding their physical dissimilarities. The same classification would compel the consideration of such an incongruous pharmaceutical group as spirit of nitrous ether, stearin, and beeswax under the head of compound ethers.

It must not be understood that the present methods of grouping the carbon atoms is not of great value *in studying chemistry* from a purely chemical stand-point. Indeed, with the enormous advances which have been made in theoretical chemistry within the last half-century, it would be impossible to reject the results upon which the present system of classification rests.

In the following pages the carbon compounds are considered in the usual groups only when the substances composing them have similar chemical and physical properties. The opening chapters are devoted to lignin and its derivatives; then its isomer, starch, and the allied products, gums, mucilages, etc.; then the sugars and the products derived from them as the result of decomposition and fermentation, alcohol, ether, etc. Following these the acid saccharine fruits, with the important acids which they contain, are considered, and then the products obtained from them and from other plants,—the volatile oils. Oleoresins, resins, gum-resins, and balsams naturally succeed these, and then the classification is based upon the prominent constituents which are found in the substances, astringents, cathartics, etc., being all grouped together. Drugs containing alkaloids are among the last groups of carbon compounds. The alkaloids are highly organized, and most of them are powerful poisons. This plan thus begins with elementary substances, like lignin, starch, and gum, and leads by regular progression to the most powerful compounds in the materia medica, the alkaloids.

A sharp distinction is made between the official and the unofficial preparations, the latter always following the former. This will enable the student to distinguish at a glance the more important compounds, and they can be studied either together or separately at will.

CHAPTER XLIX.

THE CELLULOSE GROUP.

Cellulose. $C_6H_{10}O_5$.

Cellulose.—The woody fibre of plants, which forms the skeleton or framework for the vegetable tissues, is termed *cellulose*, or *cellulin.* During the natural growth of the plant the walls of the cells become filled with various principles, coloring-matter, resins, salts of various kinds, etc., and these give to the plant physical properties which render it useful in medicine. Pharmacy teaches the various methods of extracting the *valuable principles* from plants. Cellulose constitutes the greater part of the inert residues. (See Percolation, page 263.)

The term *lignin* was formerly applied to cellulose; indeed, three words, *lignin*, *cellulin*, and *cellulose*, were used synonymously: a distinction, however, is sometimes made, the substances which are found adhering to the cellulose skeleton of plants and vegetable tissues being called *lignin.* The latter is less digestible than cellulose, and it is believed by Payen and others to vary from it somewhat in chemical composition. *Fungin*, from fungi, *hordein*, from barley, *medullin*, from the pith of various plants, *pollenin*, from pollen granules, are mixed and special forms of cellulose.

Cellulose is seen in a pure form in raw cotton, the hairs of the seed of various species of Gossypium, and in many other vegetable products. It is the most useful and valuable substance obtained from plants: fabrics like cotton, linen, or hemp goods are made on an immense scale from cellulose. When pure, cellulose is white, translucent, unalterable in the air, and has the specific gravity of 1.5. It is insoluble in water, alcohol, ether, benzin, and oils, but is soluble in an ammoniacal solution of copper oxide, and this latter fact has been taken advantage of to form many useful articles by partially dissolving a woven cotton material and rolling or pressing it into any desired shape. When cellulose is treated with strong sulphuric acid or phosphoric acid, it is converted into dextrin. If the mixture be diluted with water and heated, glucose is produced. If cellulose in the form of unsized paper is passed through a mixture made from two parts of sulphuric acid of sp. gr. 1.840 and one part of water (*both by measure*), and the whole *cooled to* 15° C. (59° F.), the valuable product known as *parchment-paper* is produced. The strips of paper should be well washed by passing them through a dilute solution of ammonia and water. This paper is useful as a dialyzing medium; it forms, when perfect, the best septum. (See Dialysis.) When cellulose is treated with nitric acid, pyroxylin, or gun cotton, is produced.

GOSSYPIUM PURIFICATUM. *U.S.* Purified Cotton.

[GOSSYPIUM, PHARM. 1880. ABSORBENT COTTON.]

The hairs of the seed of *Gossypium herbaceum* Linné, and of other species of *Gossypium* (nat. ord. *Malvaceæ*), freed from adhering impurities, and deprived of fatty matter.

Purified cotton wool is cellulose in one of its purest forms. For a long time one of the most important uses of this valuable staple, that of an absorbent and substitute for sponge, was neglected, because a trace of fatty matter was permitted to remain, which coated the filaments and prevented them from absorbing liquids freely and uniformly. The so-called absorbent cotton of commerce was introduced, and it soon became an important product. This is cotton freed from the trace of fatty matter by boiling it in a weak alkaline solution, rinsing it in a weak solution of chlorinated lime to whiten it, dipping it into a very dilute solution of hydrochloric acid, and then thoroughly rinsing it with pure water; the cotton, having been thoroughly dried, is then carded. The loss is about ten per cent. The official tests are as follows: Purified Cotton should be perfectly free from all visible impurities, and, on combustion, should not leave more than 0.8 per cent. of ash. When Purified Cotton, previously compressed in the hand, is thrown on the surface of cold water, it should readily absorb the latter and sink, and the water should not acquire either an acid or an alkaline reaction (evidence of proper purification). Cellulose is employed in pharmacy in the form of filtering paper, in muslin and cotton cloth strainers, for surgical bandages, paper, lint, etc.

Products resulting from the Decomposition of Cellulose.

Under this head will be included—1. The preparations made by decomposing cellulose or lignin by the action of acids or alkalies. 2. Those made by destructive distillation.

Pyroxylin is placed in the first class, primarily because of its importance in pharmacy, medicine, and the arts.

PYROXYLINUM. *U.S.* Pyroxylin.

[SOLUBLE GUN COTTON. COLLOXYLIN.]

	Metric.	Old form.
Purified Cotton	100 Gm.	½ oz. av.
Nitric Acid	1400 C.c.	7 fl. oz.
Sulphuric Acid	2200 C.c.	11 fl. oz.
Alcohol,		
Ether,		
Water, each, a sufficient quantity.		

Mix the Acids gradually in a glass or porcelain vessel, and, when the temperature of the mixture has fallen to 32° C. (90° F.), add the Purified Cotton. By means of a glass rod imbue it thoroughly with the Acids, and allow it to macerate, until a sample of it, taken out, thoroughly washed with a large quantity of Water, and subsequently with Alcohol, and pressed, is found to be soluble in a mixture of 1 volume of Alcohol and 3 volumes of Ether. Then remove the Cotton from the Acids, transfer it to a larger vessel, and wash it, first, with

cold Water, until the washings cease to have an acid taste, and then with boiling Water, until they cease to redden blue litmus paper. Finally, drain the Pyroxylin on filtering paper, and dry it in small, detached pellets, by means of a water-bath or steam-bath, at a temperature not exceeding 60° C. (140° F.). Keep the Pyroxylin, loosely packed, in well-closed vessels* containing not more than about 25 Gm., in a cool and dry place, remote from lights or fire.

Schönbein first pointed out the fact that nitric acid acts on cotton and produces a soluble compound. It was subsequently proved that this substance, pyroxylin, or gun cotton, belongs to a series of closely related nitro-compounds in which the nitric acid radicle replaces the hydroxyl of the cellulose formula. This may be shown by taking the double formula for cellulose $C_{12}H_{20}O_{10}$ and the displacement of the HO, thus:

$$\underset{\text{Nitric Acid.}}{6HNO_3} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose-hexanitrate.}}{C_{12}H_{14}O_4(NO_3)_6} + \underset{\text{Water.}}{6H_2O.}$$

$$\underset{\text{Nitric Acid.}}{5HNO_3} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose-pentanitrate.}}{C_{12}H_{15}O_5(NO_3)_5} + \underset{\text{Water.}}{5H_2O.}$$

$$\underset{\text{Nitric Acid.}}{4HNO_3} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose-tetranitrate.}}{C_{12}H_{16}O_6(NO_3)_4} + \underset{\text{Water.}}{4H_2O.}$$

$$\underset{\text{Nitric Acid.}}{3HNO_3} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose-trinitrate.}}{C_{12}H_{17}O_7(NO_3)_3} + \underset{\text{Water.}}{3H_2O.}$$

$$\underset{\text{Nitric Acid.}}{2HNO_3} + \underset{\text{Cellulose.}}{C_{12}H_{20}O_{10}} = \underset{\text{Cellulose-dinitrate.}}{C_{12}H_{18}O_8(NO_3)_2} + \underset{\text{Water.}}{2H_2O.}$$

The soluble pyroxylin used in preparing collodion is a varying mixture of the di-, tri-, tetra-, and pentanitrates. The hexanitrate is the true explosive gun cotton, and is insoluble in ether, alcohol, and water.

Uses.—Pyroxylin has been used very largely by photographers for producing the basis of the sensitized film upon which impressions are made. It is now replaced to a great extent by gelatin. The composition known as *celluloid*, which is used so largely for useful and ornamental articles, is made from pyroxylin, camphor, and coloring-matter heated together and powerfully pressed into appropriate moulds. Pharmaceutically, pyroxylin is used in collodions (see page 337).

Official Preparations of Pyroxylin.

Collodium . . . . Collodion. — This is made by introducing 30 Gm. of pyroxylin in a suitable bottle and adding 750 C.c. of ether and allowing it to stand for fifteen minutes, to permit the penetration of the ether to all parts of the pyroxylin; 250 C.c. of alcohol are now added, and the mixture shaken until the pyroxylin is dissolved. Pyroxylin, even of the best quality, is never entirely soluble: hence the direction to decant the liquid from any sediment and transfer it to bottles. The sediment consists of little filaments, probably of unaltered cotton: many physicians prefer to shake the bottle so as to incorporate the sediment, under the belief that the film is stronger on account of their presence. Collodion is used to protect inflamed surfaces by applying a small quantity with a brush: a thin, closely adherent film remains after the ether and alcohol evaporate; this film is contractile, and is useful on this account in many minor surgical operations. It is desirable at times to have a flexible film, especially when applied to parts of the body which are required to be in motion. The following preparation may then be used (see page 337).

[1] Notwithstanding the official directions, pyroxylin should not be kept in tin cans or glass bottles having covers or stoppers which fit closely, as decomposition will be almost certain to occur: paper boxes or cartons are proper retainers.

Official Preparations of Pyroxylin.—Continued.

Collodium Flexile . . . Flexible Collodion.	This is made by mixing 50 Gm. of Canada turpentine and 30 Gm. of castor oil with 920 Gm. of collodion. If an astringent application is needed to a bleeding surface, the styptic collodion may be employed (see page 338).
Collodium Stypticum . Styptic Collodion.	This is made by placing 20 Gm. of tannic acid in a graduated bottle, adding 5 C.c. of alcohol, 25 C.c. of ether, and sufficient collodion to make 100 C.c., then agitating until the tannic acid is dissolved. If a blistering effect is desired, the cantharidal collodion may be used (see page 338).
Collodium Cantharidatum. Cantharidal Collodion.	This is made by percolating 60 Gm. of powdered cantharides with commercial chloroform until the cantharides are exhausted, then recovering by distillation all but one-fifth of the percolate, and, after evaporating the residue by a water-bath to 15 Gm., mixing it with 85 Gm. of flexible collodion. Cantharidin, the vesicating principle of cantharides, is very soluble in chloroform, and, although the first cost of the menstruum is greater than that of ether (the solvent formerly used), it has the advantage over ether of not being inflammable. There is considerable loss of menstruum in carrying out the process practically. The percolator shown on page 433 may be used, and distillation very carefully performed with a condenser having a large refrigerating surface (see page 338).

ACIDUM OXALICUM. *Oxalic Acid.*

$H_2C_2O_4 2H_2O$; 125.7.

This acid was omitted from the alphabetical list of chemical substances in the U. S. Pharmacopœia: it is found, however, in the official test-solutions.

Preparation.—Oxalic acid may be made by acting on cellulose, sugar, or starch with nitric acid, with the aid of heat, but is prepared on a commercial scale by heating saw-dust with a mixture of two molecules of caustic soda and one molecule of potassa. The mixture of caustic alkalies and saw-dust is made in a thick paste, and then heated for several hours to a temperature of 200° C. (392° F.) to 220° C. (428° F.). The gray mass is then washed with sodium carbonate, whereby the potash is removed as carbonate, the less soluble sodium oxalate remaining. This is converted into calcium oxalate by milk of lime, and the calcium salt is then decomposed with sulphuric acid. The impure oxalic acid is then purified by recrystallization.

It occurs in small, colorless, prismatic crystals, which are odorless and have a very sour taste; it is slightly efflorescent in dry air, fusible at 98° C. (208° F.), and entirely volatile at a red heat.

The crystals should dissolve in not less than eight to ten parts of distilled water at 15° C. (59° F.) (greater solubility indicating contamination with adherent nitric acid). It is soluble in 4.5 parts of absolute alcohol, and in 7 parts of alcohol, and almost insoluble in ether, chloroform, benzol, and benzin. It fuses in its water of hydration at 98° C. (208.4° F.), although continued exposure to a heat of 60° C. (140° F.) to 70° C. (158° F.) will render it perfectly anhydrous. Solutions of oxalic acid at 100° C. (212° F.) lose acid by sublimation, and at 157° C. (314.6° F.) it sublimes rapidly. If the heat rise to 160° C. (320° F.), much loss of acid occurs.

It combines with salifiable bases, and forms salts called oxalates. The most important of these are the three *potassium salts,—oxalate, binoxalate,* and *quadroxalate* (acid potassium oxalate plus free oxalic acid),

ammonium oxalate (used as a test), and *calcium oxalate.* The binoxalate and quadroxalate, both popularly called *salt of sorrel* or *essential salt of lemons*, are employed for removing iron moulds from linen, and act by their excess of acid, which forms a soluble salt with the ferric oxide constituting the stain.

This acid in solution combines readily with lime, and forms with it an insoluble white precipitate consisting of calcium oxalate, which is insoluble in an excess of oxalic or acetic acid, but is dissolved by dilute hydrochloric acid.

Uses.—This acid is used analytically in volumetric estimations, particularly of alkalies. It is valuable in this connection, because a pure acid may be easily obtained. The indications afforded are generally distinct, and the solution may be made quickly. (See Test-Solutions.)

The best antidote to poisoning by oxalic acid is a paste made by mixing prepared chalk or powdered chalk with water or lime water: it must be administered promptly and freely.

Products resulting from the Destructive Distillation of Cellulose and Lignin.

When wood is distilled in close vessels many products are obtained. These vary with the kind of wood used, the care used in the distillation, and the temperature at which the distillation is effected. When dry hard woods (oak, walnut, or beech) are distilled, about 25 per cent. of charcoal is obtained, the liquid portion amounts to about 53 per cent., whilst the remainder, 22 per cent., is represented by waste products, principally uncondensible gases, carbon dioxide, carbon monoxide, etc. The principal solid, liquid, and gaseous products are shown by the following list:

Solids.—Charcoal, inorganic salts, etc. **Liquids.**—1. Aqueous liquid, containing *acetic, formic, butyric, crotonic, capronic, propionic acids, acetone, methylic alcohol, furfurol, methylamine, pyrocatechin,* and small quantities of empyreumatic oils and resins. 2. *Tarry liquid*, containing *toluol, xylol, cumol, methol, mesitylene, pseudocumol, phenol, cresol, guaiacol, creasol, phlorol, and methylcreasol, naphthalene, paraffin, pyrene, chrysene, retene, mesit.* **Gases.**—*Carbon dioxide, carbon monoxide, marsh-gas, acetylene, ethylene, propene,* and others. The most important products are charcoal, tar, acetic acid, acetone, methylic alcohol, and creasote. Of these, charcoal has been considered in Part III.

ACIDUM ACETICUM. *U.S.* Acetic Acid.

A liquid composed of 36 per cent. of absolute Acetic Acid [$HC_2H_3O_2$; 59.86] and 64 per cent. of water.

Preparation.—The best acetic acid for pharmaceutical and medical uses is now made by subjecting oak wood, cut into small billets, to a carefully regulated heat, the temperature being much less than that necessary to produce charcoal. The advantages are that the production of the empyreumatic substances which constitute the most objectionable impurities in the commercial acid is largely curtailed, the process being

at the same time more economical, as the residue of slightly darkened wood is more valuable than the completely charred carbon left by the ordinary process (see U. S. Dispensatory, 17th edition, p. 19).

Acetic acid is also made by distilling *vinegar*, a liquid made by the oxidation of dilute alcoholic liquids, such as cider, wine, etc. In Germany acetic acid is made by mixing alcohol with water in the proportion of eight parts of the former to ninety-two parts of the latter, and then pouring it upon beech-wood shavings, so that as it trickles through it is oxidized by the action of the air in contact. Aldehyde is an intermediate product in this process.

Acidum Aceticum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A clear, colorless liquid, wholly volatilized by heat. Sp. gr. 1.048 at 15° C. (59° F.).	Strong, vinegar-like odor; purely acid taste; strongly acid reaction.	Cold, All proportions. Boiling, All proportions.	Cold, All proportions. Boiling, All proportions.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
Neutralized with ammonia water, it is colored deep red by ferric chloride T.S., and decolorized by strongly acidulating with sulphuric acid. To neutralize 6 Gm. should require 36 C.c. of normal potassium hydrate V.S. (each C.c. corresponding to one per cent. of the absolute acid), phenolphtalein being used as indicator.	Lead, Copper, etc.	When Acetic Acid is diluted with 20 volumes of water, it should neither become colored nor yield a precipitate with hydrogen sulphide T.S.
	Copper.	No blue tint when slightly supersaturated with ammonia water.
	Fixed Impurities.	No residue left on evaporating the above alkaline liquid on a water-bath.
	Empyreumatic Substances.	No smoky odor nor taste when slightly supersaturated by sodium or potassium hydrate T.S. If 5 drops of decinormal potassium permanganate V.S. be mixed with 2 C.c. of the Acid, previously diluted with 10 C.c. of water, and contained in a clean glass-stoppered vial, the pink tint should not change at once to brown, but should change only gradually, and not become entirely brown, or free from pinkish-brown, in less than half a minute.
	Sulphuric Acid.	Diluted with 10 volumes of water, should not yield a precipitate nor turbidity with barium chloride T.S.
	Hydrochloric Acid.	Diluted with 10 volumes of water, should not yield a precipitate nor turbidity with silver nitrate T.S.
	Sulphurous or Formic Acid.	Neutralized by ammonia and mixed with some silver nitrate T.S., and warmed, it should not turn dark nor deposit a dark-colored precipitate.

Two strengths of acetic acid are found in commerce,—the official acid, which has the sp. gr. 1.048, and the No. 8 acid, as it is called, which is still very largely used: the latter has the sp. gr. 1.040, and is 20 per cent. weaker than the official acid. It is termed "No. 8" because it was formerly used in the proportion of one part in eight to make the ordinary diluted acetic acid, or distilled vinegar. The salts of acetic acid are termed acetates; they are all soluble in water, and may be recognized by heating with sulphuric acid, when the odor of

acetic acid will be developed; a neutral solution of an acetate is colored deep red by a solution of ferric chloride, and, if the mixture is boiled, a brownish-red oxyacetate is precipitated.

ACIDUM ACETICUM DILUTUM. *U. S.* Diluted Acetic Acid.

	Metric.	Old form.
Acetic Acid	100 Gm.	8 fl. oz.
Distilled Water	500 Gm.	42 fl. oz.
To make	600 Gm.	50 fl. oz.

Mix them.

This is the liquid which is used as the menstruum for the official vinegars (see page 436): it contains 6 per cent. of absolute acetic acid, $HC_2H_3O_2$, and has the sp. gr. 1.008. To neutralize 24 Gm. of Diluted Acetic Acid should require 24 C.c. of potassium hydrate V.S. (each C.c. corresponding to 0.25 per cent. of the absolute acid), phenolphtalein being used as indicator. Diluted acetic acid is superior to vinegar as a menstruum, because of its greater purity, more uniform strength, and freedom from color.

ACIDUM ACETICUM GLACIALE. *U. S.* Glacial Acetic Acid.

$HC_2H_3O_2$; 59.86.

Nearly or quite absolute Acetic Acid.

Preparation.—This acid (which is termed "glacial" because of its glassy appearance at low temperatures) is made by fusing carefully fifty-four parts of pure crystallized sodium acetate; the residue is coarsely powdered, placed in a retort, mixed with forty parts of pure concentrated sulphuric acid, and distilled: the distillate is glacial acetic acid.

$$\underset{\text{Sodium Acetate.}}{NaC_2H_3O_2} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Glacial Acetic Acid.}}{HC_2H_3O_2} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4}.$$

Acidum Aceticum Glaciale. *U. S.*	Impurities.	Tests for Impurities.
A clear, colorless liquid, of a strong, vinegar-like odor, and a very pungent, purely acid taste. Somewhat below 15° C. (59° F.) the Acid becomes a crystalline solid. When crystallized by cold, it becomes liquid again at about 15° C. (59° F.). At 117°-118° C. (242.6°-244.4° F.) it boils, evolving inflammable vapors. When the Acid is cooled to a temperature as near as possible to 15° C. (59° F.), but yet in a liquid form, its specific gravity should not be higher than 1.058, corresponding to at least 99 per cent. of absolute acid. To neutralize 3 Gm. should require not less than 49.5 C.c. of potassium hydrate V.S. (each C.c. corresponding to 2 per cent. of the absolute acid), phenolphtalein being used as indicator.	Empyreumatic Substances.	Tint produced by adding 2 drops of decinormal potassium permanganate V.S. to 2 C.c. of the Acid diluted with 10 C.c. of water, contained in a clean glass-stoppered vial, should not be changed to brown within two hours.

The specific gravity of glacial acetic acid (100 per cent.) is 1.0553, and the specific gravity of 43 per cent. acid is nearly the same, 1.0552, whilst 80, 79, 78, and 77 per cent. acids have exactly the same density,

—namely, 1.0748. It will thus be seen that specific gravity cannot be relied upon as a criterion for strength. The glacial acid may, however, be distinguished from the 43 per cent. acid by adding 10 per cent. of water, when, if the density increases, the specimen is the stronger acid. (See Oudemans' table, U. S. Dispensatory, 17th ed., page 19.)

Uses.—Glacial acetic acid is a solvent for oil of lemon and other oils; it is used in the solution of ferric acetate, and, medicinally, it is a caustic and vesicant when applied externally. It is often sold in various disguises as a corn-solvent.

PIX LIQUIDA. *U. S.* Tar.

An empyreumatic oleoresin obtained by the destructive distillation of the wood of *Pinus palustris* Miller, and of other species of *Pinus* (nat. ord. *Coniferæ*).

Tar is usually obtained as a by-product in the manufacture of charcoal or acetic acid (see page 775). It is thick, viscid, semi-fluid, blackish-brown, heavier than water, transparent in thin layers, becoming granular and opaque by age; having an acid reaction, an empyreumatic, terebinthinate odor, and a sharp, empyreumatic taste; slightly soluble in water, soluble in alcohol, in fixed or volatile oils, and in solution of potassa or of soda. The volatile products of tar are expectorant, and tar inhalations are often used. Externally, tar is stimulating, and is used in skin diseases.

Official Preparations.

Syrupus Picis Liquidæ . . . Syrup of Tar.	Made by washing 75 Gm. of tar, mixed with 100 Gm. of sand, with cold water, pouring 400 C.c. of boiling distilled water upon the residue, adding 100 C.c. of glycerin, filtering the solution, and dissolving 800 Gm. of sugar in the filtrate (see page 307). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).
Unguentum Picis Liquidæ . Tar Ointment.	Made by mixing 500 Gm. of tar with 125 Gm. of yellow wax and 375 Gm. of lard, straining, and stirring until cold.

OLEUM PICIS LIQUIDÆ. *U. S.* Oil of Tar.

A volatile oil distilled from Tar.

Oil of tar is an almost colorless liquid when freshly distilled, but soon acquires a dark, reddish-brown color, having a strong, tarry odor and taste, and an acid reaction. Sp. gr. about 0.970. It is readily soluble in alcohol.

The constituents of oil of tar are complex and numerous (see page 775): the residue left after the distillation of tar is *black pitch*. The oil is preferred to tar for most medicinal uses, because the insoluble and inert substances have been separated.

OLEUM CADINUM. *U. S.* Oil of Cade.

[OLEUM JUNIPERI EMPYREUMATICUM.]

A product of the dry distillation of the wood of *Juniperus Oxycedrus* Linné (nat. ord. *Coniferæ*).

Oil of cade is a dark brown, clear, thick liquid, having an empyreumatic odor and burning taste. Sp. gr. about 0.990. It is almost insoluble in water, only partially soluble in alcohol, but completely soluble in ether, chloroform, and carbon disulphide. Its uses in medicine are the same as those of tar and oil of tar.

CREOSOTUM. *U.S.* Creosote.

Preparation.—This is a product of the distillation of wood-tar, consisting mainly of the following phenols: *guaiacol*, or *oxycresol*, $C_7H_8O_2$, boiling at 200° C. (392° F.), *creosol*, $C_8H_{10}O_2$, boiling at 217° C. (422.6° F.), *methyl-creosol*, $C_9H_{12}O_2$, boiling at 214° C. (417° F.) to 218° C. (424.4° F.), and *phlorol*, $C_8H_{10}O_1$, boiling at 219° C. (426.2° F.). The lower oily layer which forms in the distillate from wood-tar is treated with potassium carbonate to neutralize the acid present. Fractional distillation is now resorted to, with alternate treatment of the distillate with sulphuric acid and solution of potassa to separate impurities; the liquid is finally distilled, and the portion coming over between 205° C. (401° F.) and 220° C. (428° F.) is considered to be creosote. Nearly all the liquid sold for and labelled "creosote" in the market is impure carbolic acid or coal-tar creosote. It may be distinguished from true wood creosote by the tests given below. The odor of each is distinctive and characteristic.

Creosotum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Other Solvents.
An almost colorless or yellowish-pinkish, highly refractive, oily liquid, turning to reddish-yellow or brown by exposure to light. It begins to boil at about 205° C. (401° F.), and most of it distils over between 205° and 215° C. (401°–419° F.). When cooled to —20° C. (—4° F.) it becomes gelatinous, but does not solidify (difference from *carbolic acid*). It is inflammable, burning with a luminous, smoky flame. When applied to the skin, it produces a white stain.	Penetrating, smoky odor; burning, caustic taste; neutral or only faintly acid reaction. Sp. gr. not below 1.070 at 15° C. (59° F.).	At 15° C. (59° F.), 150 parts to a somewhat turbid liquid. Hot, 120 parts, forms a clear liquid which on cooling becomes turbid from the separation of minute oily drops. The filtrate from this yields a reddish-brown precipitate with bromine T.S. (distinction from *carbolic acid*).	Dissolves, in all proportions, in absolute alcohol, ether, chloroform, benzin, carbon disulphide, acetic acid, and fixed and volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
Creosote may be distinguished from carbolic acid by the following tests. Creosote does not coagulate albumen or collodion. If 1 volume of Creosote be mixed with 1 volume of glycerin, a nearly clear mixture will result from which the Creosote will be separated by the addition of 1 or more volumes of water. On adding to 10 C.c. of a saturated aqueous solution of Creosote 1 drop of ferric chloride T.S., the liquid acquires a violet-blue tint, which rapidly changes to greenish and brown, with formation, usually, of a brown precipitate. If 1 C.c. of Creosote be mixed with a warm, 20-per-cent. solution of potassium hydrate in absolute alcohol, a solid, crystalline mass will form upon cooling.	Neutral Oils.	On mixing 2 C.c. of Creosote with 8 C.c. of a 7.5-per-cent. solution of sodium hydrate, a clear, pale yellowish liquid results which becomes turbid when diluted with water, but clears up after 50 C.c. have been added.
	Cœrulignol and some other high boiling constituents of Wood-tar.	If 1 C.c. of Creosote be shaken with 2 C.c. of benzin and 2 C.c. of freshly prepared barium hydrate T.S., upon separating, the benzin should not be blue or muddy, and the aqueous layer should not have a red tint.

Uses.—Creosote is a powerful antiseptic. It is used as a caustic application, and is frequently applied upon cotton to exposed nerves in teeth, when it acts as a local anæsthetic. It is also hæmostatic when applied to bleeding surfaces. In the form of creosote water it is used internally to check nausea. When taken internally, undiluted, and in large doses, it is a powerful poison. The administration of mucilaginous drinks, and the prompt evacuation of the stomach by the stomach-pump, would be the best treatment, no antidote to poisoning by creosote being known. In phthisis it is given internally in doses of fifteen minims (1 C.c.) per day.

Official Preparation.

Aqua Creosoti . . Creosote Water.	One-per-cent. aqueous solution of creosote (see page 289). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

Unofficial Products of the Destructive Distillation of Cellulose and Allied Substances.

Acetone, C_3H_6O. Di-methyl-ketone. Pyroacetic Spirit.	A colorless, limpid liquid, of a peculiar ethereal odor and a burning taste. It is an excellent solvent for nearly all resins, gums, camphor, and fats. Acetone occurs largely in some varieties of wood spirit, and is a constant product of the dry distillation of acetates; it is also obtained from the residue left after manufacturing aniline by the distillation of nitrobenzene with acetic acid and iron.
Acetophenone, C_8H_8O, or $C_6H_5CO.CH_3$. Hypnone. Phenyl-methyl-ketone.	Hypnotic. Dose, three to ten grains (0.19 to 0.6 Gm.).
Methylic Alcohol, CH_3HO.	It occurs among the products of the dry distillation of wood. The watery liquid is separated from the tar and distilled; then the first portion of the distillate is rectified over slaked lime, so as to remove acid, etc., and the product treated with sulphuric acid to remove tar and neutralize ammonia and methylamine, and, lastly, redistilled. It is a colorless, limpid liquid, of a peculiar odor, resembling alcohol and acetic ether, and of a warm taste. It is a good solvent for volatile oils, fats, and many resins.

Products resulting from the Natural Decomposition of Cellulose and Lignin and their Derivatives.

Coal is fossil fuel, which is found in the earth at various depths, and which has been formed by the decomposition of the cellulose, lignin, and other constituents of vegetable matter under the changing influences of moisture, temperature, and pressure to which it is subjected. The differences in the structure and composition of coal are undoubtedly due to the variations in these influences, as well as to the alterations in the character of the vegetable substances.

Coal-Tar.—Many valuable compounds have been contributed by recent researches to the arts and medicine from this formerly useless by-product. Coal-tar is a residue left after the dry distillation of bituminous coal in the process for making illuminating gas (see page 113). It is a very complex substance: its composition varies considerably with the temperature at which the distillation of the coal is effected, the yield of solid bodies and of gases being larger when the temperature is higher, while at a lower temperature the liquid portion of the tar is in increased amount. When coal-tar is submitted to distillation and rectification, it yields a brown, oily liquid, known technically as *light oil*, and consisting

of benzol, toluol, etc.; then a black liquid, *dead oil*, is obtained, which contains aniline, naphtalin, phenol, etc.; the residue in the still is pitch, sometimes called *asphalt*. The products may be arranged in three classes.

1. *Solids.*—Naphtalin, $C_{10}H_8$, methyl-naphtalin, $C_{11}H_{10}$, acetyl-naphtalin and diphenyl, $C_{12}H_{10}$, fluoren, $C_{13}H_{10}$, anthracen and phenanthren, $C_{14}H_{10}$, fluoranthen, $C_{15}H_{10}$, methyl-anthracen, $C_{15}H_{12}$, reten, $C_{16}H_{12}$, chrysen, $C_{18}H_{12}$, pyren, $C_{16}H_{10}$, and carbazol, $C_{16}H_{11}N$.

2. *Liquids.*—These may be neutral hydrocarbons, acids, and ethers of the same, or bases. The *neutral hydrocarbons* are benzol, C_6H_6, toluol, C_7H_8, methyl-toluol and iso-xylol, C_8H_{10}, pseudocumol and mesitylen, C_9H_{12}, and cymol, $C_{10}H_{14}$. The *acid constituents* are phenol, C_6H_6O, kresol, orthokresol, parakresol, and metakresol, C_7H_8O, phlorol, $C_8H_{10}O$, rosolic acid, $C_{20}H_{16}O_3$, pyrocatechin, $C_6H_6O_2$, and kreosot, consisting of the methyl ethers of pyrocatechin and its homologues, $C_7H_8O_2$, $C_8H_{10}O_2$, and $C_9H_{12}O_2$. There are also present, probably in combination with the ammonia of the ammoniacal liquor, acetic, butyric, carbonic, hydrocyanic, sulphocyanic, and hydrosulphuric acids. The *bases* are ammonia, NH_3, methylamine, CH_3,NH_2, ethylamine, C_2H_5,NH_2, phenylamine, C_6H_5,NH_2, pyridine, C_8H_5N, picoline, C_6H_8N, lutidine, C_7H_9N, collidine, $C_8H_{11}N$, leukoline, C_9H_7N, iridoline, $C_{10}H_9N$, kryptidine, $C_{11}H_{11}N$, acridine, $C_{12}H_9N$, coridine, $C_{10}H_{15}N$, rubidine, $C_{11}H_{17}N$, and viridine, $C_{12}H_{19}N$.

3. *Gases.*—(*a.*) *Illuminating gases.* Acetylen, C_2H_2, ethylen, C_2H_4, propylen, C_3H_6, butylen, C_4H_8, allylen, C_3H_4, crotonylen, C_4H_6, teren, C_5H_8, and vapors of benzol, C_6H_6, styrolene, C_8H_8, naphthalin, $C_{10}H_8$, methyl-naphthalin, $C_{11}H_{10}$, fluoren, $C_{13}H_{10}$, fluoranthen, $C_{15}H_{10}$, propyl, $(C_3H_7)_2$, and butyl, $(C_4H_9)_2$.

(*b.*) *Heating and diluting gases.* Hydrogen, H_2, marsh-gas (methane), CH_4, and carbon monoxide, CO.

(*c.*) *Impurities.* Carbon dioxide, CO_2, ammonia, NH_3, cyanogen, $(CN)_2$, methyl-cyanide, CH_3,CN, sulphocyanic acid, CN,SH, hydrogen sulphide, H_2S, carbon disulphide, CS_2, carbon oxysulphide, COS, and nitrogen, N_2.

NAPHTALINUM. *U.S.* Naphtalin.

$C_{10}H_8 = 127.7.$ [NAPHTALENE.]

A hydrocarbon obtained from coal-tar. It should be kept in well-stoppered bottles.

On subjecting coal-tar to distillation this substance passes over into the condensing vessels immediately after the naphtha.

Naphtalinum. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, shining, transparent laminæ. Slowly volatilized on exposure to air.	Strong, characteristic odor, resembling that of coal-tar; burning, aromatic taste; neutral reaction.	Insoluble, but when boiled with it the latter imparts a faint odor and taste to the water.	At 15° C. (59° F.), 15 parts. Boiling, Very soluble.	Very soluble in ether, chloroform, carbon disulphide, and fixed and volatile oils.

Tests for Identity.	Impurities.	Test for Impurities.
Naphtalin volatilizes slowly at ordinary temperatures; rapidly when heated. It also volatilizes with the vapors of water or alcohol. At 80° C. (176° F.) it melts, and at 218° C. (424.4° F.) it boils. Its vapor is inflammable, burning with a luminous and smoky flame. When ignited, it is consumed, leaving no residue.	Contaminations derived from Coal-tar.	On shaking a small portion of Naphtalin with concentrated sulphuric acid, the acid should remain colorless, and should not acquire more than a pale reddish tint if the mixture be heated for five minutes on a water-bath.

Uses.—Naphtalin, or *coal-tar camphor*, is used almost exclusively as an insecticide, to prevent the ravages of moths in woollen clothing. For this purpose it has to a large extent replaced camphor.

NAPHTOL. *U. S.* Naphtol.

$C_{10}H_7OH = 143.66.$ [Beta-Naphtol.]

A phenol occurring in coal-tar, but usually prepared artificially from naphtalin. Naphtol should be kept in dark amber-colored, well-stoppered bottles.

When naphtalin is digested with sulphuric acid, two acids are formed. When one of these (alpha-naphtalin sulphonic acid) is heated with sulphuric acid, the beta variety is formed; and when the latter is fused with an alkaline hydrate, beta-naphtol (the official naphtol) is produced.

Naphtol. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless or pale buff-colored, shining, crystalline laminæ, or a white, or yellowish-white, crystalline powder, permanent in the air. When heated, Naphtol sublimes easily. It is also volatilized with the vapors of alcohol or water. It melts at 122° C. (251.6° F.), and boils at 286° C. (546.8° F.). On ignition it is consumed, leaving no residue.	Faint, phenol-like odor, and a sharp and pungent but not persistent taste; neutral reaction.	At 15° C. (59° F.), 1000 parts. Boiling, 75 parts.	At 15° C. (59° F.), 0.75 part. Boiling, Very soluble.	Very soluble in ether, chloroform, or solutions of caustic alkalies.

Tests for Identity.	Impurities.	Tests for Impurities.
A cold, saturated, aqueous solution of Naphtol, when mixed with ammonia water, exhibits a faint bluish fluorescence. Chlorine or bromine water added to the aqueous solution produces a white turbidity, which disappears on adding ammonia water in excess. On adding about 0.1 Gm. of Naphtol to about 5 C.c. of an aqueous solution (1 in 4) of potassium hydrate, then about 1 C.c. of chloroform, and gently warming, the aqueous layer will acquire a blue tint, changing after a while to green and brown. Ferric chloride T.S. colors the aqueous solution of Naphtol greenish, and, after some time, causes the separation of white flakes, which turn brown upon the application of heat. A piece of pine wood dipped into an aqueous solution of Naphtol, and afterwards moistened with diluted hydrochloric acid, becomes green on exposure to daylight.	Naphtalin.	Naphtol should dissolve in 50 parts of ammonia water without leaving a residue,
	Other Organic Impurities.	And the solution should not have a deeper tint than pale yellow.
	Absence of, and distinction from, *alpha-naphtol*, which produces at once a crimson color, turning deep blue in the upper part of the zone on standing.	If 0.1 Gm. of Naphtol be mixed, in a test-tube, with 1 drop of syrup and 5 C.c. of water, and about 3 C.c. of concentrated sulphuric acid be then poured into the tube held in a slanting position, so that the liquids may form separate layers, a yellowish-brown color will appear at the zone of contact, which becomes darker on standing.

Uses.—Naphtol is used as an antiseptic in skin diseases. It retards the growth of bacteria, and has been given internally in doses of three to five grains (0.2 to 0.33 Gm.).

ACETANILIDUM. *U. S.* Acetanilid.

$C_6H_5NH.C_2H_3O = 134.73.$ [PHENYLACETAMIDE.]

An acetyl derivative of aniline.

Acetanilid, or *antifebrin*, is made by heating a mixture of aniline and glacial acetic acid to the boiling point; the cooled, congealed residue is purified by sublimation or recrystallization.

Acetanilidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
White, shining, micaceous, crystalline laminæ, or a crystalline powder, permanent in the air.	Odorless, having a faintly burning taste; neutral reaction.	At 15° C. (59° F.), 194 parts. Boiling, 18 parts.	At 15° C. (59° F.), 5 parts. Boiling, 0.4 part.	In 18 parts of ether, easily soluble in chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated to 113° C. (235.4° F.), Acetanilid melts. Upon ignition, it is consumed without leaving a residue. When agitated with colorless, concentrated sulphuric acid, in a clean test-tube, it dissolves without imparting color to the liquid. On boiling 0.1 Gm. of Acetanilid for several minutes with 2 C.c. of hydrochloric acid, a clear solution results which, when mixed with 3 C.c. of a 5-per-cent. aqueous solution of carbolic acid, and afterwards with 5 C.c. of a filtered, saturated solution of chlorinated lime, acquires a brownish-red color, becoming blue upon supersaturation with ammonia.	Isonitril.	On heating about 0.1 Gm. of Acetanilid with a few C.c. of concentrated solution (1 in 4) of potassium or sodium hydrate, the characteristic odor of aniline becomes noticeable. On now adding chloroform, and again heating, the disagreeable odor of isonitril (which is poisonous) is evolved.
	Aniline Salts and various Allied Substances.	A cold saturated, aqueous solution of Acetanilid, added to ferric chloride T.S., should not affect the color of the latter.

Uses.—Acetanilid is an antipyretic, reducing temperature, and in moderate doses producing diaphoresis. The dose is from five to ten grains (0.3 to 0.6 Gm.).

ACIDUM CARBOLICUM CRUDUM. *U. S.* Crude Carbolic Acid.

A liquid consisting of various constituents of coal-tar, chiefly cresol and phenol, obtained by fractional distillation.

Preparation.—That portion of the heavy oil obtained by distilling coal-tar which comes over between 165° C. (329° F.) and 190° C.

(374° F.) is technically called "dead oil," which name was given to this fraction of the crude distillate because it was formerly believed to have no value. When "dead oil" is redistilled, the product is crude carbolic acid: if the latter is redistilled, the first distillate is principally water, until the temperature of 165° C. (329° F.) is reached. From this point to 185° C. (365° F.) nearly pure and crystallizable phenol, or carbolic acid, will distil over, whilst the portion received between the temperatures of 185° C. (365° F.) and 195° C. (383° F.) will not crystallize, but will consist mainly of cresol and other phenols. At temperatures from 195° C. (383° F.) to 211° C. (411.8° F.), cresol, C_7H_8O, and xylenol, $C_8H_{10}O$, are obtained. Crude carbolic acid consists of phenol, with small quantities of cresol and other phenols. According to Dr. Squibb, however, it is principally the second distillate above mentioned, from 185° C. (365° F.) to 195° C. (383° F.), and consists mainly of cresol.

Acidum Carbolicum Crudum. *U. S.*	Tests for Identity.
A nearly colorless or reddish-brown liquid, of a strongly empyreumatic and creosote-like odor; having a benumbing, blanching, and caustic effect on the skin or mucous membrane; slightly acid reaction in aqueous solution; gradually turning darker on exposure to air and light.	Bromine water produces, in an aqueous solution of Carbolic or Cresylic Acid, a white, flocculent precipitate. The crude Acid should not dissolve in less than 15 parts of water, nor should the solution have an alkaline reaction. If 50 volumes of the crude Acid be diluted with warm water and the mixture well shaken, cooled, and allowed to separate, the amount of undissolved impurities should not exceed 5 volumes, or 10 per cent. by volume of the crude acid.

Uses.—Crude carbolic acid is a powerful antiseptic, and is largely used in hospitals and in domestic practice as a disinfectant. It is well adapted for this purpose; and if it is of the official quality, it is superior to pure carbolic acid, as cresol is known to be more energetic than phenol. For profuse use, two parts of crude carbolic acid should be thoroughly agitated with eighty-eight parts of water, and, after the mixture has been allowed to stand a short time, the solution filtered.

ACIDUM CARBOLICUM. *U. S.* Carbolic Acid.

$C_6H_5OH = 93.78.$ [Phenol.]

A constituent of coal-tar, obtained by fractional distillation, and subsequently purified.

Preparation.—This valuable product is properly termed phenol, and it belongs to a well-marked class of hydrocarbons of which it is the type. It is made by distilling crude carbolic acid, and separating and purifying the distillate by repeated crystallizations. When perfectly pure, carbolic acid is devoid of the odor of creosote, but it has a peculiar aromatic odor, which is not disagreeable.

Acidum Carbolicum. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
Colorless, separate, or interlaced, needle-shaped crystals, or a white, crystalline mass, sometimes acquiring a reddish tint, deliquescent on exposure to moist air. When gently heated, Carbolic Acid melts, forming a highly refractive liquid. When liquefied by a gentle heat and slowly cooled, under constant stirring, until partly recrystallized, the semi-liquid mass should show a temperature not lower than 35° C. (95° F.); boiling point should not be higher than 188° C. (370.4° F.). The crystals melt at 35°–42° C. (95°–107.6° F.), and boil at 181°–188° C. (357.8°–370.4° F.),—the higher melting and the lower boiling points being those of the pure and anhydrous acid. On continued heating the Acid is completely volatilized. The vapor of the Acid is inflammable.	Distinctive, slightly aromatic odor resembling that of creosote; when diluted, a sweetish taste, with a slightly burning after-taste; faintly acid reaction.	15 parts. 100 parts of the crystals are liquefied by the addition of about 8 parts of water. The solubility in water varies according to the degree of hydration of the Acid.	Very soluble.	Very soluble in ether, chloroform, benzol, carbon disulphide, glycerin, and fixed and volatile oils. Almost insoluble in benzin.

Tests for Identity.	Impurities.	Tests for Impurities.
Carbolic Acid coagulates albumen or collodion (difference from *creosote*). With bromine water its aqueous solution forms a white precipitate, which at first redissolves, but becomes permanent as more of the reagent is added, and appears crystalline under the microscope. On adding to 10 C.c. of a 1-per-cent. aqueous solution of the Acid 1 drop of ferric chloride T. S., the liquid acquires a violet-blue color which is permanent.	Creosote and Cresylic Acid.	One volume of cold, liquefied Carbolic Acid, containing 8 per cent. of water, forms, with 1 volume of glycerin, a clear liquid which is not rendered turbid by the addition of 3 volumes of water.

Quantitative Test.
If 0.039 Gm. of Carbolic Acid be tested by the method immediately following, there should be required for its complete conversion into tribromophenol not less than 24 C.c. of decinormal bromine V.S. (each C.c. of the volumetric solution corresponding to 4 per cent. of absolute Phenol).

Valuation of Carbolic Acid.—Dissolve 1.563 Gm. of the Carbolic Acid to be valued in a sufficient quantity of water to make 1000 C.c. Transfer 25 C.c. of this solution (containing 0.039 Gm. of the acid) to a glass-stoppered bottle having a capacity of about 200 C.c., add 30 C.c. of decinormal bromine V.S. (which is 5 C.c. more than would be required if the carbolic acid in the solution were absolute phenol, the excess being added to promote the formation and separation of tribromophenol), then 5 C.c. of hydrochloric acid, and immediately insert the stopper. Shake the bottle repeatedly in the course of half an hour, then remove the stopper just sufficiently to introduce quickly 5 C.c. of a 20-per-cent. aqueous solution of potassium iodide, being careful that no bromine vapor escape, and immediately stopper the bottle. Shake the latter thoroughly, remove the stopper and rinse it and the neck of the bottle with

a little water, so that the washings may flow into the bottle, and then add, from a burette, decinormal sodium hyposulphite V.S., until the iodine tint is exactly discharged, using towards the end a few drops of starch T.S. as indicator. Note the number of C.c. of decinormal sodium hyposulphite V.S. consumed. Deduct this from 80 (the number of C.c. of bromine V.S. originally added), and multiply the remainder by 4. The product will, approximately, represent the percentage of absolute Phenol in the Carbolic Acid tested.

Carbolic acid, as it is found in commerce, varies in the proportion of water that it contains, and a slight variation materially alters the melting and boiling points. The congealing point is regarded by Dr. Squibb as a better test of the quantity of real phenol present in a sample than the melting point; the congealing point should be between 29.4° C. (85° F.) and 38.5° C. (101° F.), and is ascertained by melting some of the acid in a beaker and stirring with a thermometer until it completely crystallizes. The mercury rises in the thermometer and remains constant for a considerable length of time during the congelation.

Uses.—Pure carbolic acid is largely used as an antiseptic; it is often found of two qualities, known as "No. 1 gold label" and "No. 2;" the former should be exclusively used in antiseptic surgery and for making preparations intended for internal use. It is a good practice to add one fluidounce of water to a pound of carbolic acid in the bottle, and warm the whole up on a water-bath until the solution is effected. The contents may then be used in a liquid form without the troublesome necessity of weighing the crystals.

Official Preparations.

Glyceritum Acidi Carbolici . . . . Glycerite of Carbolic Acid.	Made by mixing 20 Gm. of carbolic acid and 80 Gm. of glycerin. (See page 319.)
Unguentum Acidi Carbolici . . . . Ointment of Carbolic Acid.	5 Gm. of carbolic acid; 95 Gm. of ointment. (See Unguenta.)

RESORCINUM. *U. S.* Resorcin.

$C_6H_4(OH)_2 = 109.74.$ [RESORCINOL. METADIOXYBENZOL.]

A diatomic phenol. Resorcin should be kept in dark amber-colored vials.

Preparation.—Resorcin is usually prepared by fusing sodium benzol disulphonate with caustic soda; it may be made in several other ways,—by the destructive distillation of brazilin, or by the fusion of either galbanum, ammoniac, sagapenum, asafetida, or acroides with caustic potassa. Resorcin is a diatomic phenol isomeric with *pyrocatechin* and *hydroquinone*.

Resorcinum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
Colorless or faintly reddish, needle-shaped crystals or rhombic plates. Resorcin acquires a reddish or brownish tint by exposure to light and air. When heated to a temperature between 110° and 119° C. (230° and 246.2° F.), Resorcin melts, a higher melting point indicating a greater degree of purity. At a higher heat it is completely volatilized.	Faint, peculiar odor; disagreeable, sweetish, and afterwards pungent taste. Neutral or faintly acid reaction.	At 15° C. (59° F.), 0.6 part. Boiling, Very soluble.	At 15° C. (59° F.), 0.5 part. Boiling, Very soluble.	Readily soluble in ether or glycerin. Very slightly soluble in chloroform.

Tests for Identity.	Impurities.	Test for Impurities.
On adding a few drops of ferric chloride T.S. to 10 C.c. of a dilute aqueous solution (1 in 200) of Resorcin, the liquid assumes a bluish-violet color. If 0.1 Gm. of Resorcin be dissolved in 1 C.c. of potassium hydrate T.S. and a drop of chloroform added, the mixture, upon being heated, will assume an intense crimson color. If a slight excess of hydrochloric acid be then added, the color will change to a pale straw-yellow. On cautiously heating 0.05 Gm. of Resorcin with 0.1 Gm. of tartaric acid and 10 drops of concentrated sulphuric acid, a thick, carmine-red liquid will be formed, becoming pale yellow when diluted with water.	Empyreumatic Bodies.	A concentrated aqueous solution (1 in 2) of Resorcin should be colorless, and when gently heated should not emit the odor of phenol.

Uses.—Resorcin is an antiseptic closely resembling carbolic acid in its physiological action. It is used mainly externally in various skin diseases. The dose of resorcin is two to three grains (0.13 to 0.19 Gm.).

ACIDUM SALICYLICUM. *U. S.* Salicylic Acid.

$HC_7H_5O_3$; 187.67.

Preparation.—Although salicylic acid may be obtained from several natural sources, it is now obtained, according to Kolbe's patent, by treating sodium phenol (or carbolate) with carbon dioxide. For this purpose, the most concentrated caustic soda solution is evaporated with the corresponding amount of phenol to a dry powder; this is then heated to 100° C. (212° F.), while a stream of dry carbon dioxide is passed over it. The temperature is gradually raised to 180° C. (356° F.), and increased to 220° C. (428° F.) as soon as phenol distils over, and finally raised to 250° C. (482° F.), until no more phenol distils. In the retort, the half of the phenol used remains as sodium salicylate, while the other half has distilled over unchanged. The reaction is as follows:

$$\underset{\text{Sodium Phenol.}}{2NaC_6H_5O} + \underset{\text{Carbon Dioxide.}}{CO_2} = \underset{\text{Phenol.}}{C_6H_6O} + \underset{\text{Normal Sodium Salicylate.}}{Na_2C_7H_4O_3}.$$

The sodium salt thus obtained is dissolved in water, decomposed by hydrochloric acid, and the salicylic acid filtered off, washed, and crystallized out of hot water, or purified by sublimation in a current of superheated steam or dialyzed.

Acidum Salicylicum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Fine, white, light, prismatic, needle-shaped crystals, permanent in the air, free from odor of carbolic acid.	Having sometimes a slight aromatic odor; sweetish and slightly acrid taste; acid reaction.	Cold, 450 parts. Boiling, 14 parts.	Cold, 2.4 parts. Boiling, Very soluble.	Soluble in 2 parts of ether, in 2 parts of absolute alcohol, and in 80 parts of chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated to about 156° C. (312.8° F.), the Acid begins to melt, and is completely melted at 157° C. (314.6° F.); at about 200° C. (392° F.) it begins to sublime; at a higher temperature it is volatilized and decomposed with odor of carbolic acid, and without leaving more than 0.6 per cent. of fixed residue. The saturated, aqueous solution is colored intensely bluish-violet and violet-red, in high dilution, by ferric chloride T.S.	Hydrochloric Acid.	A solution of 0.5 Gm. of the Acid, in a clean test-tube, in 10 C.c. of alcohol, mixed with a few drops of nitric acid, should remain unaffected upon the addition of a few drops of silver nitrate T.S.
On adding to a small portion of the Acid, in a test-tube, about 1 C.c. of concentrated sulphuric acid, then, cautiously, about 1 C.c. of methylic alcohol, in drops, and heating the mixture to boiling, the odor of methyl salicylate will be evolved.	Iron, Carbolic Acid, or Coloring Matter.	A saturated solution of the Acid in absolute alcohol, when allowed to evaporate spontaneously in an atmosphere free from dust, should leave a perfectly white crystalline residue, without a trace of color at the points of the crystals.
	Readily Carbonized Organic Impurities.	On treating about 0.5 Gm. of the Acid, in a clean test-tube, with 10 C.c. of concentrated sulphuric acid, no color should be imparted to the latter within fifteen minutes.
	Carbolic Acid.	If 1 Gm. of the Acid be dissolved in an excess of cold sodium carbonate T.S., the liquid agitated with an equal volume of ether, and the ethereal solution allowed to evaporate spontaneously, the residue, if any, should have no odor of carbolic acid.

Uses.—Salicylic acid is an important product. It is used as an antipyretic, in doses of seventy-five grains, given in divided doses until the temperature is lowered. Its principal use is in rheumatism and gout, the dose being ten grains (0.6 Gm.). Three solid salts of the acid are official,—sodium, lithium, and physostigmine salicylates. The first is a very valuable salt, and is generally relied upon now for the internal administration of the acid. Methyl salicylate, or artificial oil of wintergreen, was added at the last revision of the U. S. Pharmacopœia.

SALOL. *U. S.* Salol.

$C_6H_5C_7H_5O_3 = 213.49.$ [Phenyl Salicylate.]

The salicylic ether of phenol.

Preparation.—Salol is prepared by heating salicylic acid with phenol in the presence of phosphorus pentachloride or phosphorus oxychloride; the elements of water are withdrawn by this action, and the phenyl group is caused to unite with the salicylate radical.

Salol. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, crystalline powder, permanent in the air. When heated to 42°–43° C. (107.6°–109.4° F.), Salol melts. When heated on platinum, it takes fire, and is consumed, leaving no residue.	Odorless, or having a faintly aromatic odor; almost tasteless; neutral reaction.	Almost insoluble.	At 15° C. (59° F.), 10 parts. Boiling, Very soluble.	Soluble in 0.3 part of ether. Readily soluble in chloroform, and in fixed or volatile oils.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
On warming a small portion of Salol with enough sodium hydrate T.S. to dissolve it, and then supersaturating the liquid with hydrochloric acid, salicylic acid will separate, and the odor of phenol will become perceptible. In an alcoholic solution of Salol, bromine water, added in excess, produces a white precipitate. On adding a few drops of dilute ferric chloride T.S., made by diluting the test-solution with 20 volumes of water to 10 C.c. of an alcoholic solution (1 in 50) of Salol, the liquid will acquire a violet tint. If, however, a few drops of the alcoholic solution of Salol be added to 10 C.c. of the diluted ferric chloride T.S., a whitish cloudiness, but no color, will be produced on shaking.	Uncombined Carbolic or Salicylic Acid.	On shaking 1 Gm. of Salol with 50 C.c. of water, the filtrate should not be affected by ferric chloride T.S. previously diluted with 20 volumes of water,
	Sulphate or Phosphate.	Nor by barium chloride T.S.,
	Chloride.	Nor by silver nitrate T.S.

Uses.—Salol is used as an internal antiseptic, it being decomposed in the small intestine, when in contact with alkaline fluids, into carbolic and salicylic acids. The dose is from fifteen to thirty grains (0.97 to 2 Gm.).

Unofficial Products of the Destructive Distillation of Coal-Tar.

Acetylphenylhydrazin, $C_6H_5NH,—NH.CH_3CO$ (Pyrodin, Hydracetin).	Antipyretic. Powerful remedy. Dose, one-half to one grain (0.03 to 0.06 Gm.) per day.
Agathin, $C_6H_4(OH)CH = N.N(CH_3).C_6H_5$, Salicyl-α-methyl-phenyl-hydrazone.	Antiseptic and anti-neuralgic. Dose, eight to ten grains (0.52 to 0.65 Gm.).
Aniline, C_6H_7N.	Prepared by treating an alcoholic solution of nitrobenzol with ammonia and hydrogen sulphide until a precipitation of sulphur takes place. The brown liquid is again saturated with hydrogen sulphide until sulphur ceases to be deposited. The liquid is then mixed with excess of acid, filtered, boiled, and then distilled with excess of caustic potash. A colorless, limpid, oily, inflammable liquid, of a peculiar wine-like odor and burning, aromatic taste. It is used chiefly in the preparation of aniline dyes.
Antipyrin (Phenyl-dimethyl-pyrazolon), $C_6H_5(CH_3)_2C_3HN_2O$.	It is found as a white, crystalline powder which is very freely soluble in cold water. It gives an intense red coloration with ferric chloride; with nitrous acids or nitrites it turns emerald-green. It is one of the most successful of the antipyretics. Dose, fifteen to forty grains (0.9 to 2.6 Gm.).
Antisepsin (Asepsin, Monobromacetanilid, Parabromacetanilid), $C_6H_4Br.NH(C_2H_3O)$.	Antipyretic, analgesic, and antiseptic. Dose, six to seven grains (0.40 to 0.46 Gm.).
Antithermin (Phenylhydrazin-lævulinic Acid), $C_6H_5N_2H = C(CH_3).C_2H_5O_2$.	In colorless crystals, insoluble in cold water. Dose, three grains (0.2 Gm.).
Asaprol (Calcium α-mono-sulphonate of β-naphtol), $C_{10}H_6\begin{cases}OH\\SO_3\end{cases}$ $\begin{matrix}SO_3\\SO_3\end{matrix}>Ca$ $C_{10}H_6\begin{cases}SO_3\\OH.\end{cases}$	Antipyretic, anti-rheumatic. Dose, fifteen to sixty grains (0.971 to 3.88 Gm.).
Benzol, C_6H_6.	Obtained by subjecting coal-tar to fractional distillation. A thin, colorless, very inflammable liquid, having an aromatic odor. Nearly insoluble in water; soluble in alcohol, ether, etc. It is a valuable solvent. In Europe it is often termed *benzene*, and it is sometimes employed as a thermo-cautery.
Benzo-Naphtol (Benzoyl-Naphtol, Benzoate of Naphtol).	Antiseptic. Dose, four to eight grains (0.260 to 0.518 Gm.), repeated frequently.

Unofficial Products of the Destructive Distillation of Coal-Tar.—*Continued.*

Benzosol (Benzoyl-Guaiacol), $C_6H_4\left\{\begin{array}{l}OCH_3\ (1)\\ OCO.C_6H_5\ (2).\end{array}\right.$	Dose, seven grains (0.5 Gm.).
Betol (Naphthalol), Salicylate of β-Naphtol, $C_6H_4OH.COOC_{10}H_7$.	Antiseptic, in place of salol. Dose, five to twenty grains (0.3 to 1.2 Gm.).
Borophenol.	Disinfectant. A combination of borax and carbolic acid.
Chinoline, C_9H_7N.	By mixing aniline, nitrobenzol, glycerin, and sulphuric acid, heating, then diluting with water and distilling to drive off nitrobenzol; on rendering the residue alkaline and distilling with steam, chinoline passes over. A colorless, mobile liquid, having a pungent, somewhat bitter-almond odor, and a bitter taste. Sp. gr. 1.081.
Chlorphenol, Monochlorphenol, $C_6H_4Cl.OH$.	Germicide and antiseptic. Used by inhalation, and as a local application.
Creolin.	Said to be an emulsion of cresol obtained by means of resin soap.
Cresol Iodide (Losophan), $C_6HI_3(CH_3)OH$.	A yellow powder, containing 80 per cent. of iodine. Soluble in alcohol, insoluble in water. Used as an external application in skin diseases, in the form of a solution or of an ointment.
Cresol-Naphtol.	A brown, viscous, tar-like liquid, having active germicide properties.
Cresotinic Acid (Cresotic Acid), $C_6H_3\left\{\begin{array}{l}CH_3\\ OH\\ COOH.\end{array}\right.$	The para-acid is used as an antipyretic and antirheumatic.
Dinitrocresol, $C_6H_2(NO_2)_2\left\{\begin{array}{l}CH_3\\ OH.\end{array}\right.$	"Saffron Substitute" is a mixture of the potassium salts of dinitro-, ortho-, and para-cresols.
Dioxynaphthalene, $C_{10}H_8O_2$.	Tonic. Dose, three grains (0.194 Gm.) a day.
Di-phenyl-methyl-pyrazole.	A substitute for antipyrin in the form of white needles. not very soluble in water or ether; easily soluble in alcohol and glacial acetic acid.
Dithio-salicylic Acid, $\begin{array}{l}C_6H_3(OH)COOH.S\\ C_6H_3(OH)COOH.S\end{array}>$.	Antirheumatic. Dose, three grains (0.194 Gm.).
Eosin, $C_{20}H_8Br_4O_5$.	A bronze-colored, crystalline powder, obtained from the action of phthalic acid upon phenols. Eosin is largely used as a dye, and for making a brilliant red ink, by dissolving 5 grains in a fluidounce of water in which 10 grains of acacia have been dissolved.
Europhen, Di-isobutyl-ortho-cresol-iodide, $2\left(\begin{array}{l}C_4H_9\\ CH_3\end{array}\right\}C_6H_3O)HI$.	Microbicide. A local irritant. Dose, one-half to one and a half grains (0.03 to 0.1 Gm.). Used also hypodermically, dissolved in oil.
Fluorescin, $C_{20}H_{12}O_5$.	Yellowish-red or dark red powder. Soluble in alcohol with yellow-red color and green fluorescence.
Fuchsin (Rosaniline), $C_{20}H_{19}N_3$.	A non-volatile, colorless, bitter substance, produced whenever a mixture of aniline and toluidine is heated to about 180° C. with an oxidizing agent of moderate power, as, for example, arsenic acid. The solutions of some of its acid salts are used largely for dyeing silk and wool a magnificent crimson.
Gallacetophenol, $C_6H_2\left\{\begin{array}{l}OH_3\\ CH_3CO.\end{array}\right.$	Proposed as a substitute for pyrogallic acid as a local application.
Guaiacol (Oxycresol) (Methyl Ether of Pyrocatechin).	Dose, one to one and one-half grains (0.06 to 0.1 Gm.).
Hydro-quinone, Hydrochinone, $C_6H_4(HO)_2$.	Prepared by oxidising aniline with chromic acid mixture. Dose, five to ten grains (0.3 to 0.6 Gm.).
Hypnone (Acetophenone), C_8H_8O.	A colorless liquid, having an almond-like odor, insoluble in water or glycerin, soluble in alcohol and ether. Used as a hypnotic in doses of ten to twenty minims (0.6 to 1.2 C.c.).

Unofficial Products of the Destructive Distillation of Coal-Tar.—*Continued.*

Ichthyol.	A tarry-looking substance, obtained from a brownish mineral, containing animal residues of fish, etc., found in Sufeld, in Tyrol. Purified by distillation and treatment with sulphuric acid. Ichthyol has an herb-like odor, and is faintly alkaline. Used for skin diseases. Dose, ten to fifteen grains (0.6 to 0.9 Gm.).
Iodantifebrin, Iodacetanilid, $C_6H_4INH(C_2H_3O)$.	In rhombic flakes. Melting at 181.5° C. Very slightly soluble in cold water, readily soluble in alcohol.
Iodophenacetin (Iodophenine).	A powerful germicide.
Oleum Succini, Oil of Amber.	Amber is a fossil resin of an extinct coniferous wood, found principally upon the Baltic coast. By destructive distillation an acid liquor containing succinic acid is produced, together with crude oil of amber: the latter is redistilled, and rectified oil of amber is the product. It is a pale yellow liquid, having an empyreumatic odor and a warm, acrid taste. Sp. gr. 0.920. It is soluble in alcohol, and when mixed with fuming nitric acid acquires a red color and is subsequently converted into a brown resinous mass known as *artificial musk*.
Orcin, Dihydroxytoluene, $C_6H_3(CH_3)(OH_2)$.	Antiseptic, antipyretic. Poisonous.
Orexin, Phenyldihydrochinazolin Hydrochlorate, $C_6H_4\left\{\begin{array}{l}CH_2N.C_6H_5\\N{=}CHHCl.\end{array}\right.$	Stomachic. Dose, four to seven grains (0.26 to 0.42 Gm.) two to three times a day.
Orthin, Orthohydrazin-paraoxybenzoate.	A feeble antipyretic.
Oxychinaseptol (Diaphtherin), $C_6H_4(SO_2)\left\{\begin{array}{l}O{-}NH.C_9H_6(OH)\\O{-}NH.C_9H_6(OH).\end{array}\right.$	A powerful antiseptic.
a-Oxynaphthoic Acid, $C_{10}H_6\left\{\begin{array}{l}OH\\COOH.\end{array}\right.$	Antizymotic, disinfectant. Used in the form of a 5-per-cent. ointment.
Phenacetin (Para-acet-phenetidin).	Prepared by acting on para-phenetidin with glacial acetic acid. A valuable and largely used analgesic. Dose, ten to fifteen grains (0.6 to 0.9 Gm.).
Phenolphtalein, $C_{20}H_{14}O_4$.	Prepared by digesting 10 parts phenol, 5 parts phthalic anhydride, and 4 parts concentrated sulphuric acid for several hours at 120°–130° C., then boiling the residuum with water to remove soluble matter. The resinous substance so left is boiled in benzol for purification. It is a yellowish-brown powder. The test-solution used as an indicator is prepared by dissolving 1 part phenolphtalein in 30 parts 90 per cent. alcohol.
Phenylhydrazine, $C_6H_5.NH.NH_2$.	Poisonous. Used as a test for sugar in urine.
Phthalic Acid, $C_8H_6O_4$.	Produced by heating salicylic acid with a mixture of sulphuric acid and potassium ferrocyanide, and, when the reaction is ended, treating the resulting mass with ether, which extracts the phthalic acid. It occurs in nacreous laminæ or shining monoclinic prisms. Soluble in alcohol, ether, and benzol.
Picric Acid, $C_6H_3N_3O_7$.	Prepared by dissolving crystallized carbolic acid in strong sulphuric acid, and adding nitric acid to the resultant sulphophenic acid. It is purified by neutralizing with sodium carbonate and filtering to separate resin, then adding to the filtrate excess of sodium carbonate, when sodium picrate is precipitated. This salt is decomposed by sulphuric acid, and the picric acid crystallized. It is much employed for dyeing wool and silk yellow, also for staining wood.
Pyrazole, $C_3H_4N_2\left(\begin{array}{l}CH{=}N\\ \mid\\ CH{=}CH\end{array}\right\rangle NH).$	Dose, fifteen to thirty grains (0.972 to 1.94 Gm.) daily.

Unofficial Products of the Destructive Distillation of Coal-Tar.—*Continued.*

Pyridine, C_5H_5N.	Remedy for asthma. Five to twenty drops in two ounces of water may be used by an atomizer, or five drops may be inhaled directly. Dose, six drops, gradually increased to twenty-five, daily.
Pyridine Nitrate, $C_5H_5N.HNO_3$.	Colorless needles. Easily soluble in water, less so in alcohol.
Pyridine Sulphate, $(C_5H_5N)_2.SO_4H_2$.	Crystalline. Very soluble in water or in alcohol.
Rosolic Acid (Corallin).	Obtained by acting on commercial phenol with oxalic and sulphuric acids.
Salicylamide, $C_6H_4\left\{\begin{matrix}OH\\CONH_2\end{matrix}\right.$.	Analgesic and antipyretic. Dose, three grains (0.194 Gm.).
Salicyl Bromanilid (Antinervine).	Antipyretic and analgesic. Dose, five to ten grains (0.324 to 0.648 Gm.).
Salipyrin, Antipyrin Salicylate.	Antipyretic, antirheumatic, antineuralgic. Dose, seven to fifteen grains (0.45 to 0.97 Gm.), in capsule or tablet.
Salol-Camphor.	A local anæsthetic, a mixture of salol and camphor.
Salophen, Acetylparamidophenyl-salicylate, $C_6H_4\left\{\begin{matrix}OH\\COOC_6H_4.NH(C_2H_3O)\end{matrix}\right.$.	Antirheumatic and intestinal antiseptic. Dose, forty-five to seventy-five grains *during the day* (2.9 to 4.85 Gm.)
Sozolic Acid, Orthophenolsulphonic Acid, $C_6H_4(HSO_3)OH$.	Antiseptic. A 33⅓-per-cent. solution is called aseptol.
Succinic Acid, $C_4H_6O_4$.	Used with advantage in delirium tremens.
Sulpho-Carbolic Acid (Sulphophenic Acid), $C_6H_6SO_4$.	This substance is produced by the direct action of concentrated sulphuric acid upon carbolic acid. It is soluble in water and in alcohol. The acid is a decided antiseptic, and its solutions coagulate albumen.
Tetrahydro-β-Naphthylamine, $C_{10}H_7.H_4.NH_2$.	A local mydriatic, used in from 1- to 5-per-cent. solution.
Thalline (Tetrahydroparaquinanisol), $C_9H_6H_4N(OCH_3)$.	An antipyretic. The sulphate and tartrate are most used. The dose of either is from two to five grains (0.1 to 0.3 Gm.).
Tribromphenol, $C_6H_2Br_3.OH$.	Antiseptic.
Trichlorphenol, $(C_6H_2Cl_3OH)$.	Used in erysipelas, in the form of a glyceride containing 5 to 10 per cent., applied to the parts twice daily.
Tropæolin.	Dye-color used as an indicator in volumetric analysis.
Tumenol.	Used as a local application in eczema, in a 10-per-cent. solution.
Xylol (Xylene), C_8H_{10}.	By treating the oily liquid separating from diluted crude wood-spirit and from the light oil of wood-tar or coal-tar, first with sulphuric acid, and afterwards subjecting these liquids to fractional distillation, collecting only that portion which distils between 136° and 140° C. (277° and 286° F.). A thin, colorless, oily liquid, resembling benzol. It has a burning taste. Soluble in alcohol. Dose, twenty to thirty grains (1.2 to 1.9 Gm.).

QUESTIONS ON CHAPTER XLIX.

THE CELLULOSE GROUP.

What is cellulose? What is its formula in symbols? What is lignin?
What are some other special forms of cellulose?
Give an example of pure cellulose. Describe it, and give specific gravity.
In what solution is it soluble, and to what purpose is this fact applied?
When cellulose is treated with strong sulphuric acid, what change takes place?
If the mixture be diluted with water and heated, what will be produced?
How is parchment paper made, and for what is it used?
When cellulose is treated with nitric acid, what is produced?
Cotton—What is the Latin official name? What kind of cotton is meant?
How is it obtained? For what purposes in pharmacy is cellulose used?
Pyroxylin—What is the Latin official name? How is it made?
What compounds are made by the action of nitric acid on cellulose?
Explain the reactions which take place in their formation.
What is celluloid? For what purposes is it used?
Oxalic acid—Give its formula in symbols and molecular weight.
How may it be made? Describe odor, taste, chemical reaction, and solubility.
In combination with bases, what salts does it form?
What are the most important of these salts?
What is "salt of sorrel" or "essential salt of lemons"?
How do these act in removing iron rust from linen?
For what is oxalic acid used?
In case of poisoning by oxalic acid, what is the best antidote?
What is the result when wood is distilled in close vessels?
From dry hard woods about what per cent. of charcoal is obtained, and about what per cent. of liquid products?
Name some of the principal solid, liquid, and gaseous products.
Of these products, which are the most important?
Acetic acid—What is the official Latin name?
How much absolute acetic acid does it contain? Give its formula in symbols and molecular weight.
How is the best acid for medicinal purposes obtained?
How is acetic acid made in Germany? Describe odor, taste, chemical reaction, and solubility. Give tests for its identity.
How may the following impurities be detected?—viz.: Lead, copper, tin; iron; calcium; copper; acetic acid and fixed impurities; empyreumatic substances; organic substances; nitric acid; sulphuric acid; hydrochloric acid; sulphurous acid.
What two strengths of acid are found in commerce?
Why is one of them called No. 8?
What is the specific gravity of each of these acids?
What is the difference between the two kinds?
What are the salts of acetic acid called? How may they be recognized?
Diluted acetic acid—What is the Latin name? Give description and specific gravity. How is it made, and for what is it used?
How much absolute acetic acid does it contain?
Why is it superior to vinegar as a menstruum?
Glacial acetic acid—What is the Latin official name? Give its formula in symbols and molecular weight.
How is it made? Give rationale of process. Describe odor, taste, and chemical reaction. What is its specific gravity? How may its strength be tested?
Can its specific gravity be relied on as a criterion of its strength? Why?
How may the glacial acid be distinguished from the weaker acid having the same specific gravity?
For what substances is glacial acetic acid a solvent? What are its uses?
Tar—What is the Latin official name? What is it, and how is it obtained?
Describe its physical properties. What are its uses?
What official preparations are there of tar?
Oil of tar—What is the Latin official name? How is it obtained? Give description and specific gravity.

What is black pitch?

Why is it generally preferred to tar for medicinal uses?

Oil of cade—What is its Latin official name? How is it obtained? Give description and specific gravity. What are its uses?

What is creosote, and of what phenols does it consist?

How is it obtained? Describe odor, taste, chemical reaction, and solubility.

How may it be distinguished from carbolic acid? What are its uses?

In case of poisoning by it, what would be the proper treatment?

What official preparation is there of creosote?

What is the strength of it, and what is the dose?

What is coal? Explain the differences in its structure and composition.

What is coal tar?

When coal tar is subjected to distillation and rectification, what products does it yield? 1. Solids; 2. Liquids; 3. Gases.

Naphtalin—What is its Latin official name? How is it obtained? Give description, tests, and uses.

Naphtol—What is its Latin official name? How is it obtained? Give description, tests, dose, and uses.

Acetanilid—What is its Latin official name? What other names are used for it? How is it made? Describe its appearance, tests, and solubilities. What are its medical properties? Give the dose.

What is crude carbolic acid? What is the Latin official name?

What is "dead oil"?

When dead oil is redistilled, what is the product?

Is this product uniform in composition?

Of what does it consist, and how may its constituents be separated?

According to Dr. Squibb, of what does crude carbolic acid mainly consist,

Describe odor, taste, and chemical reaction.

For what purpose and how is it used?

Carbolic acid—Give formula in symbols and molecular weight.

What is carbolic acid? Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Creosote and cresylic acid; water. What is a good test of the quantity of phenol present?

Are the official tests for solubility in water and that for showing the amount of water present correct?

For what purpose is it used? What official preparation is there of it?

What is the strength of the ointment?

Resorcin—What is its Latin official name? What other names are given to it? How is it obtained? Describe its appearance, tests, and solubilities. What are its medical properties? Give the dose.

Salicylic acid—Give Latin name, formula in symbols, and molecular weight.

Describe Kolbe's patent process for obtaining it. Give rationale of the process.

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Hydrochloric acid; organic impurities and iron; foreign organic matter; carbolic acid.

What is the dose? What salts of this acid are official?

Salol—What is its Latin official name? What other name is sometimes used for it? How is it obtained? Describe its appearance, tests, and solubilities. What are its medical properties? Give the dose.

CHAPTER L.

AMYLACEOUS AND MUCILAGINOUS PRINCIPLES AND THEIR PRODUCTS.

STARCH has the same chemical composition as cellulose, $C_6H_{10}O_5$, and is closely allied to it in its properties. Starch is stored up in plants in anticipation of future usefulness in the formation of their cell-walls, growing tissues, or other constituents. It exists in the form of granules, which in young and small plants appear to be always spherical; their shape subsequently becomes ovoid, lenticular, polyhedral, or irregular, and it is possible to identify the varieties of starch obtained from various plants, with the aid of the microscope, by the shape and size of the granules.

The granules consist of layers of different densities, arranged concentrically around a central point termed the hilum, which is usually at one end of the granule. Corn starch is official.

AMYLUM. *U. S.* Starch.

The fecula of the seed of *Zea Mays* Linné (nat. ord. *Gramineæ*).

Starch is present in many drugs, and is an important constituent of many vegetable foods.

Preparation.—Starch is made from potatoes by first grating them, and then pressing the soft mass upon a sieve, which separates the cellular substances and permits the starch granules to fall through. These must be thoroughly washed, the quality of starch depending largely upon the purity of the water that is used in washing it. In making starch from wheat or corn the gluten must be separated. This is generally done by permitting it to become sour and disintegrated through acetous fermentation; stopping the fermentation before the starch is affected. Upon the small scale, starch may be made from wheat flour by placing it in a fine linen bag and kneading it whilst a small stream of water is trickling on it. The starch is carried off with the water, whilst the gluten remains as a soft mass in the bag.

Starch by the action of diluted acids, diastase, or heat is converted into *dextrin*, a substance resembling gum in appearance and properties Dextrin is largely dissolved by water, hot or cold, and forms a mucilaginous solution, from which it is precipitated by alcohol. Large quantities of dextrin are now made both here and abroad, and employed for various purposes in the arts, under the name of *artificial gum* or *British gum*. It is found in the market in the form of a white, brilliant powder, and in small masses or fragments resembling natural gum. It may be distinguished from gum arabic by the taste and smell of potato oil which it always possesses.

Starch is completely dissolved by calcium and zinc chlorides in concentrated solution. *Inulin*, $C_{12}H_{20}O_{10}$, is a substance closely allied to starch. It is found particularly in the plants belonging to the order Compositæ, as Inula, Taraxacum, etc. It has also been found, according to Kraus, in plants of the Campanulaceæ, Goodeniaceæ, Lobeliaceæ, and Stylidæ. It differs from starch in the following particulars: it is colored yellow by iodine, does not gelatinize with water, and is not found in plants in the form of granules having concentric layers like starch.

Amylum. *U.S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvent.
In irregular, angular masses, which are easily reduced to powder of a white color. Under the microscope appearing as granules, mostly very minute, more or less angular in form, and indistinctly striated, but with a distinct hilum near the centre.	Inodorous; tasteless.	Insoluble.	Insoluble.	Insoluble in ether.

Tests for Identity.

Triturated with cold water, it gives neither an acid nor an alkaline reaction with litmus paper. When boiled with water, it yields a white jelly having a bluish tinge, which, when cool, requires a deep blue color on the addition of iodine T.S.
When completely incinerated, Starch should leave not more than 1 per cent. of ash.

Uses.—Starch was made official because it is used in making glycerite of starch. It is used externally as an absorbent, and is applied to the skin by dusting.

Official Preparation.

Glyceritum Amyli . . Glycerite of Starch.	Starch jelly, made with 10 Gm. of starch, 10 C.c. of water, and 80 Gm. of glycerin (see page 319).

Unofficial Amylaceous Substances and Derivatives.

Acorn.	From the genus *Quercus*. Acorns contain besides starch a peculiar saccharine substance, *quercite*.
Bean.	From *Faba vulgaris* and *Phaseolus vulgaris*.
Barley.	*Hordeum distichon*. Contains 60 to 68 per cent. of starch, also gluten, gum, and sugar.
Canna.	From the rhizome of *Canna edulis*. Nat. Ord. Marantaceæ, Canneæ. Indigenous to Peru and Brasil. The starch granules are very large, and exhibit a glistening or satiny appearance. It forms a cloudy but very tenacious jelly with boiling water.
Cassava. Tapioca. Manioc.	From the root of *Manihot utilissima*. Nat. Ord. Euphorbiaceæ. Habitat, Tropical America. The starch granules are about half the size of the potato granules, in somewhat translucent pieces, inodorous, having an insipid taste.
Curcuma. Turmeric.	From the rhizome of *Curcuma longa*. Nat. Ord. Zingiberaceæ. Habitat, Southern Asia, cult. The starch granules are rather larger than those of maranta.
Maranta. Arrowroot.	From the rhizome of *Maranta arundinacea*. Nat. Ord. Marantaceæ. Indigenous to West Indies and Tropical America. Prepared by removing the scales from the rhizome, mashing and grinding in a mill until reduced to a pulp, then suspending this in water, and separating the fibrous portion, either by hand or sieve; lastly, washing thoroughly, and drying with a gentle heat. The yield is from 13 to 20 per cent. of fecula. It forms an opaque jelly with concentrated hydrochloric acid.
Oats.	From *Avena sativa*. Nat. Ord. Gramineæ. Habitat, Asia, cult. The grain contains 64 to 66 per cent. of starch, besides protein compounds, fat, salts, etc.

Unofficial Amylaceous Substances and Derivatives.—*Continued.*

Pea.	From *Pisum sativum.* It yields about 37 per cent. of starch.
Potato.	From the tubers of *Solanum tuberosum.* Nat. Ord. Solanaceæ. Habitat, Europe and America. Prepared by drenching washed and rasped potatoes in a sieve with a continuous stream of cold water, allowing the liquid to stand for a short time, and washing repeatedly the granules which collect at the bottom of the liquid; lastly, drying carefully. The yield is about 20 per cent. It is largely used as an adulterant.
Sweet Potato.	From *Convolvulus Batatus.* The yield of starch is about 16 per cent.
Rice.	From *Oryza sativa.* Prepared by heating rice with weak soda-lye, which dissolves the nitrogenous impurities and leaves pure starch, then adding a solution of borax to facilitate the separation of the starch from the gluten. The yield is about 88 per cent.
Rye.	From *Secale cereale.* The yield of starch is about 64 per cent.
Sago.	From the pith of *Metroxylon Sagu.* Nat. Ord. Palmæ. Prepared by powdering the pith of the tree, washing with water to remove woody tissue and other impurities; lastly, drying carefully and granulating.
Wheat.	From *Triticum vulgare.* Nat. Ord. Gramineæ. Formerly official, now replaced by corn starch.
Malt.	The seed of *Hordeum distichon* Linné (Nat. Ord. Gramineæ), caused to enter the incipient stage of germination by artificial means and dried. When barley is steeped for two or three days in water, it swells, becomes somewhat tender, and the water is colored reddish-brown. If the water is drained off, and the barley is spread about two feet thick upon a floor (a stone floor is generally used), it heats spontaneously, and germination begins, the radicle making its appearance first. The growth of the grain is partially stopped at this stage by spreading it more thinly, and turning it over for two days. It is then raked into heaps and allowed to stand a day, when it becomes hot, and is subsequently thoroughly dried in a kiln by a slow, regulated heat. This is malt, and it differs in quality according as it is more or less soaked, drained, germinated, dried, or baked. It is distinguished by its color, being pale, amber, brown, or black malt, according to the degrees of heat used in drying it. The object of converting grain into malt is to change the *starch,* naturally present in the grain, into *maltose,* a peculiar kind of sugar, and dextrin. This is effected through the presence of *diastase,* a peculiar and powerful ferment, which is developed during the partial germination to which the grain is subjected in malting. A portion of the starch is always left unchanged by the process of germination, its conversion into maltose being completed during the heating in the kiln. The diastase which is developed is capable of converting into maltose much more starch than is contained in the grain in which it is produced: hence, if good malt be added to a certain quantity of unmalted grain, the starch in the latter may be also converted into maltose. Malt seldom contains diastase in larger proportion than two parts in a thousand. It is obtained by bruising fresh malt, adding about half its weight of water, expressing strongly, treating the viscid liquid thus obtained with sufficient alcohol to destroy its viscidity, then separating the coagulated albumen, and adding a fresh portion of alcohol, which precipitates the diastase in an impure state. To render it pure, it must be redissolved as often as three times in water, and precipitated by alcohol. Diastase is solid, white, tasteless, soluble in water and in weak alcohol, but insoluble in the latter fluid when concentrated. Though without action upon gum and sugar, it has the extraordinary property, when mixed, in the proportion of only one part to two thousand, with starch suspended in water, and maintained at a temperature of about 71.1° C. (160° F.), of converting that principle into dextrin and *maltose.* Although malt has been manufactured in large quantities for centuries for brewing purposes, it has only recently been employed in medicine, in the form of extracts of malt, malt foods, etc. Its usefulness in this connection is due to the fact that the amount of diastase present in good malt has the power of *rendering soluble starchy substances which are taken into the stomach as food;* and good preparations of malt are not only easily digested food-products themselves, but also actively aid in the digestion of other substances. Some of the commercial malt extracts consist of glucose colored with caramel and slightly flavored with extract of malt.
Extractum Malti. **Extract of Malt.**	Made by macerating and digesting 100 parts of malt, first with cold water, and then with water warmed to a temperature not exceeding 55° C. (131° F.), straining the mixture, and evaporating the strained liquid in a vacuum or at a low temperature to the consistence of thick honey.

CETRARIA. *U. S.* Cetraria. [Iceland Moss.]

Cetraria islandica Acharius (class *Lichenes*).

This lichen is found in northern latitudes on both continents. It contains 70 per cent. of *lichenin*, $C_{12}H_{20}O_{10}$, a substance which is allied to starch, and which swells up when soaked in water; about 3 per cent. of *cetraric acid*, $C_{18}H_{16}O_8$, a very bitter crystalline body; *lichenstearic acid*, $C_{14}H_{24}O_3$; sugar, oxalic acid, fumaric acid, and cellulin.

Uses.—It is used as a demulcent and nutritive when made into a jelly or decoction.

Official Preparation.

Decoctum Cetrariæ . . Decoction of Cetraria.	Made by macerating 50 Gm. of cetraria in 400 C.c. of water, expressing and throwing away the liquid (this is done to separate the bitter principle cetraric acid), then boiling the cetraria with 1000 C.c. of water, straining, and making the product up to 1000 C.c. The bitter principle may be more effectually separated by boiling the cetraria with an alkaline solution (see page 352).

CHONDRUS. *U. S.* Chondrus. [Irish Moss. Carragheen.]

Chondrus crispus Stackhouse, and *Gigartina mamillosa* J. Agardh (class *Algæ*).

This alga grows in the Atlantic Ocean. It contains 70 per cent. of a mucilaginous principle, which has been termed *carrageenin*. This differs from *gum* by not precipitating with alcohol, from *starch* by not becoming blue upon the addition of iodine, and from *pectin* by not being precipitated by lead subacetate.

Uses.—Chondrus is used principally to form a sick-diet jelly, one part being sufficient to form a jelly with sixty parts of water. It should be previously soaked in a small quantity of water, to dissolve adherent salts, and this water thrown away.

Gums and Mucilaginous Substances.

The proximate principle *arabin* (formerly termed gum) may be described as a vegetable substance, which forms with water a thick glutinous liquid, is insoluble in alcohol, and, when treated with nitric acid, is converted into mucic and oxalic acids. Three proximate principles are found in gums: 1. *Arabin*, or Arabic acid, $C_{12}H_{22}O_{11}$, the soluble form, found largely in acacia. 2. *Bassorin*, $C_{12}H_{20}O_{10}$, or insoluble gum, found in tragacanth. 3. *Cerasin* (insoluble), found in cherry gum.

Some exudations are composed of both soluble and insoluble gum. Vegetable mucilage and insoluble gum appear to be "degradation products," or compounds produced by subsequent changes in the substance of the organized structures of plants, which are of no further use to the plant in the work of building up new cell-walls. *Gums* differ from *starch*, or *cellulin*, by being soluble in water, or by swelling up in contact with it. They differ from sugars by being incapable of vinous fermentation with yeast. There will be frequent occasion to refer to the uses of gum in the subsequent chapters.

ACACIA. *U. S.* Acacia. [Gum Arabic.]

A gummy exudation from *Acacia Senegal* Willdenow (nat. ord. *Leguminosæ*).

This valuable gum consists mainly of arabic acid, or arabin, combined with lime, potassa, or magnesium, and hence it may be called calcium, potassium, or magnesium arabate. It is in roundish or amorphous pieces, or irregular fragments, of various sizes, more or less transparent, hard, brittle, pulverizable, and breaking with a shining fracture. It is usually white, or yellowish white, but frequently presents different shades of red, and is sometimes of a deep-orange or brownish color. It is bleached by exposure to the sun. In powder it is always white. It is inodorous, has a feeble, slightly sweetish taste, and when pure dissolves wholly in the mouth. The sp. gr. varies from 1.31 to 1.525 for the dried gum.

The gum dissolves at ordinary temperatures slowly, in an equal weight of water, forming a thick glutinous liquid of distinctly acid reaction. It is insoluble in alcohol, ether, and the oils. One hundred parts of diluted alcohol containing 22 per cent. of alcohol by volume dissolve fifty-seven parts of gum, diluted alcohol containing 40 per cent. of alcohol takes up ten parts, whilst 50 per cent. alcohol dissolves only four parts.

Neutral lead acetate does not precipitate its aqueous solution, but the basic acetate forms even in a very dilute solution a precipitate. Soluble silicates, borates, and ferric salts render solution of gum turbid, or thicken it to a jelly. No alteration is produced by silver salts, mercuric chloride, or iodine. Gum dissolves in an ammoniacal solution of cupric oxide.

Uses.—In pharmacy, acacia is extensively used for the suspension of insoluble substances in water, and for the formation of pills and troches. Two kinds of powdered acacia are used, one a coarse powder called *granulated*, the other *finely dusted*. The granulated dissolves more readily in water, because it has lost during desiccation only a part of its moisture, whilst in preparing the "finely dusted" powder the high heat necessarily used to dry it thoroughly, drives off nearly all the water. Its easy solubility and its absence of tendency to form "lumps" cause the coarse powder to be preferred for solutions, emulsions, etc.

Official Preparations.

Mucilago Acaciæ . . . Mucilage of Acacia.	Made by dissolving 340 Gm. of acacia in 660 Gm. of cold water, preferably made by circulatory solution (see Fig. 302, page 253).
Syrupus Acaciæ. . . . Syrup of Acacia.	Made by mixing 25 C.c. of mucilage of acacia with 75 C.c. of syrup (see page 300). The mucilage must be freshly made and free from acidity. The syrup does not keep well.

TRAGACANTHA. *U. S.* Tragacanth.

A gummy exudation from *Astragalus gummifer* Labillardière, and from other species of *Astragalus* (nat. ord. *Leguminosæ*).

This gum upon analysis was found to consist of 33 per cent. of bassorin, or insoluble gum, 53 per cent. of soluble gum (not arabin), 11 per cent. of water, and 3 per cent. of impurities.

Tragacanth is either in flaky, leaf-like pieces, or in tortuous vermicular filaments, of a whitish color, somewhat translucent, and resembling

horn in appearance. It is hard and more or less fragile, but difficult of pulverization, unless exposed to a freezing temperature, or thoroughly dried, and powdered in a heated mortar. Tragacanth has no smell, and very little taste. Its sp. gr. is 1.384. Introduced into water, it absorbs a certain proportion of that liquid, swells very much, and forms a soft adhesive paste, but does not dissolve. If agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid. The gelatinous mass is tinged blue by iodine T.S., and the fluid portion is not precipitated on the addition of alcohol. Tragacanth is wholly insoluble in alcohol. It appears to be composed of two different constituents, one soluble in water and resembling acacia, the other swelling in water, but not dissolving. The former differs from acacia in affording no precipitate with potassium silicate or ferric chloride.

Official Preparation.

Mucilago Tragacanthæ . . Made by mixing 18 Gm. of glycerin with 75 C.c. of water, heating to boiling, adding 6 Gm. of tragacanth, macerating, making the weight up to 100 Gm., and then straining forcibly through muslin (see page 314).
Mucilage of Tragacanth.

ULMUS. *U.S.* Elm. [SLIPPERY ELM.]

The inner bark of *Ulmus fulva* Michaux (nat. ord. *Urticaceæ*).

This bark contains a mucilage which is capable of being precipitated by alcohol and lead acetate from its aqueous solution. It is much used as a demulcent.

Official Preparation.

Mucilago Ulmi . . . Made by digesting 6 Gm. of bruised elm in 100 C.c. of water (see page 315).
Mucilage of Elm.

SASSAFRAS MEDULLA. *U.S.* Sassafras Pith.

The pith of *Sassafras variifolium* (Salisbury) O. Kuntze (nat. ord. *Laurineæ*).

This pith contains a delicate mucilage, which is not precipitated from its aqueous solution by alcohol. It is used for making the official mucilage, which is principally employed as an eye-wash.

Official Preparation.

Mucilago Sassafras Medullæ . . Made by macerating 2 Gm. of sassafras pith in 100 C.c. of water and straining (see page 314).
Mucilage of Sassafras Pith.

ALTHÆA. *U.S.* Althæa. [MARSHMALLOW.]

The root of *Althæa officinalis* Linné (nat. ord. *Malvaceæ*).

This root, which is generally imported from Europe, contains a large quantity of mucilage, $C_{12}H_{20}O_{10}$, associated with *asparagin*, sugar, and starch. It is used solely as a demulcent.

Official Preparation.

Syrupus Althææ. Syrup of Althæa.	This syrup is made by pouring 400 C.c. of cold water, previously mixed with 30 C.c. of alcohol, on 50 Gm. of cut althæa, macerating for one hour, then straining through flannel without expressing; 700 Gm. of sugar are added to the liquid and dissolved by agitation without heat; 100 C.c. of glycerin are then added, and enough water to make 1000 C.c. (see page 302).

LINUM. *U.S.* Linseed. [FLAXSEED.]

The seed of *Linum usitatissimum* Linné (nat. ord. *Lineæ*).

Linseed contains 15 per cent. of mucilage, $C_{12}H_{20}O_{10}$, in the epithelium, and from 20 to 35 per cent. of fixed oil in the nucleus, besides resin, sugar, wax, etc. The mucilage is soluble in water, but more readily in hot water, forming a thick, viscid liquid. Alcohol and lead subacetate precipitate it from its aqueous solution. The mucilage is an important constituent; the seed is used in its unground state for making a demulcent infusion. Ground flaxseed is very useful to the pharmacist for making lutes, and, medicinally, it is used for making poultices. The fixed oil present is very valuable because of its drying properties. (See Oleum Lini.)

Unofficial Mucilaginous Substances.

Bael-fruit.	The dried, half-ripe fruit of *Ægle Marmelos*. Nat. Ord. Aurantiaceæ. Habitat, Himalaya Mountains. Used principally in dysentery. Dose of fluid extract, 1 to 2 fluidrachms.
Baobab.	From *Adansonia digitata*. Nat. Ord. Sterculiaceæ. Habitat, Tropical Africa. Used as a tonic.
Benne Leaves.	From *Sesamum Indicum*. Nat. Ord. Pedaliaceæ. Habitat, India. Used as a stimulant.
Blue-weed.	From *Echium vulgare*. Habitat, Europe. Used chiefly as an emollient and protective.
Borage.	From *Borago officinalis*. Nat. Ord. Boraginaceæ. Habitat, Southern Europe. Used chiefly as an emollient and protective.
Cashew-nut.	From *Anacardium occidentale*. Nat. Ord. Terebinthaceæ. Habitat, Tropical America. Used externally and as a vermifuge.
Comfrey-root.	The root of *Symphytum officinale*. Nat. Ord. Boraginaceæ. Habitat, Europe. Used as a demulcent and astringent.
Cydonium, Quince Seed.	The seed of *Cydonia vulgaris*. Nat. Ord. Rosaceæ. Used for *Mucilago Cydonii*, 2 per cent. quince seed, 98 per cent. water.
Evening Primrose.	From *Œnothera biennis*. Nat. Ord. Onagraceæ. Habitat, North America.
Fenugreek.	The seeds of *Trigonella Fœnum-græcum*. Nat. Ord. Leguminosæ. Habitat, Western Asia. Used as an emollient.
Hog Gum.	From *Rhus metopium*. Habitat, South America. Used as a demulcent.
Hound's Tongue.	From *Cynoglossum officinale*. Habitat, Europe and United States. Used as an emollient and protective.
Jujube Berries.	The fruit of *Zizyphus vulgaris*. Nat. Ord. Rhamnaceæ. Habitat, Asia Minor. Used as a laxative.
Laminaria.	From *Laminaria Cloustoni*. Nat. Ord. Algæ. Habitat, North Atlantic Ocean.
Lungwort.	From *Pulmonaria officinalis*. Habitat, Europe.
Maidenhair.	The fronds of *Adiantum Capillus-Veneris*. Nat. Ord. Filices. Used as a demulcent and stimulant.
Mesquite Gum.	From *Algarobia glandulosa*. Habitat, Texas.
Mullein.	The leaves and flowers of *Verbascum Thapsus*. Nat. Ord. Scrophulariaceæ. Habitat, North America. Used as a demulcent.
Okra.	From *Hibiscus esculentus*. Habitat, Africa.
Salep.	From the tubers of *Orchis mascula*. Is very mucilaginous, only four grains being sufficient to make one fluidounce of water gelatinous.
Virginia Lungwort.	From *Pulmonaria Virginica*. Habitat, United States.
Willow Herb.	From *Epilobium angustifolium*. Nat. Ord. Onagraceæ. Used as a tonic and demulcent.

QUESTIONS ON CHAPTER L.

AMYLACEOUS AND MUCILAGINOUS PRINCIPLES.

What is starch? Give the Latin official name and description.
What is its chemical composition?
How is it made?
What change takes place when starch is subjected to the action of diluted acids, diastase, or heat?
Under what names is dextrin largely used in the arts? Describe its appearance.
How may it be distinguished from gum arabic?
In what solutions is starch soluble?
What is the composition of inulin?
Where is it found?
In what particulars does it differ from starch?
For what is starch used? Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What are the official preparations of starch?
Iceland moss—Give the Latin official name. Where is it found?
What principles does it contain?
What is its use?
What official preparation of it is there?
Irish moss—Give the Latin official name. Where does this alga come from?
What principle does it contain?
Wherein does this principle differ from gum?
Wherein does this principle differ from starch?
Wherein does this principle differ from pectin?
For what is chondrus used?
What is arabin?
What three proximate principles are found in gums?
In what gums are these principles found?
Wherein do gums differ from starch or cellulin?
Wherein do gums differ from sugars?
Gum arabic—What is the Latin official name? Describe odor, taste, and chemical reaction. What is its specific gravity?
Of what does this gum mainly consist?
Does neutral lead acetate precipitate its aqueous solution?
Does basic lead acetate precipitate its aqueous solution?
What action is produced by soluble silicates on ferric salts?
What are its uses in pharmacy?
What are the official preparations of acacia?
Tragacanth—What is the Latin official name? Whence obtained?
What are its constituents? What is its specific gravity?
What color is produced when iodine T.S. is added to mucilage of tragacanth?
Wherein does the portion soluble in water differ from acacia?
What official preparation is there of tragacanth?
Slippery elm—What is the Latin official name? Of what tree is this the bark?
What does the bark contain?
For what is it used?
What official preparation is there of it?
Sassafras pith—What is the Latin official name? Whence obtained?
What does it contain, and for what is it used?
What official preparation is there of it?
Marshmallow—What is the Latin official name? What part is official?
Where does it come from?
What does it contain, and for what is it used?
What official preparation is there of it?
Linseed—What is the Latin official name? Whence obtained?
What does it contain?
For what purposes is it used?
Why is the fixed oil especially valuable?

CHAPTER LI.

SUGARS AND SACCHARINE SUBSTANCES.

SUGARS may be defined as organic bodies having a sweet taste, generally of vegetable origin and crystallizable, of a neutral reaction, soluble in water, their solutions being optically active to polarized light. The term sugar is popularly applied to but one product, saccharose, the sweet substance obtained from sugar-cane, beets, sorghum, etc. There are, however, many sugars varying not only in external appearance and properties, but also in chemical composition. They may be divided into two classes: 1. Fermentable sugars, and, 2. Non-fermentable sugars.

1. **Fermentable Sugars.**—This is by far the more important class, as it embraces the sugars which are largely consumed in food-products. It will be found convenient to divide this class into two subclasses: *Glucoses*, or sugars *directly* subject to vinous fermentation, and *Saccharoses*, sugars *indirectly* subject to vinous fermentation. The following table shows these in detail:

Glucoses, $C_6H_{12}O_6$.

Glucose (Dextro-glucose, or Dextrose).	Rotates the plane of polarization strongly to the right. Obtained by treating starch with diluted sulphuric acid, neutralizing the acid with lime, separating the calcium sulphate, and evaporating the solution.
Grape-Sugar (Crystallized Glucose).	Obtained by crystallizing the above-named solution.
Lævulose (Lævo-glucose).	Rotates the plane of polarization strongly to the left. Found in the sugar-cane, and may be obtained from molasses, or by heating inulin under pressure with water.
Maltose, $C_{12}H_{22}O_{11} + H_2O$?	Made by the action of diastase on starch.
Dulcitose.	Obtained by oxidizing dulcite with nitric acid.
Mannitose.	Found in muscular flesh.
Galactose.	Made by treating milk-sugar with diluted sulphuric acid.

Saccharoses, $C_{12}H_{22}O_{11}$.

Fermentable only after being converted into a sugar belonging to the class of glucoses.

Cane-Sugar (Saccharose).	Obtained from sugar-cane, beets, etc. (see Saccharum).
Parasaccharose.	Produced by spontaneous fermentation of cane-sugar
Milk-Sugar (Lactose, Lactin).	Obtained from milk (see Saccharum Lactis).
Mycose.	Obtained from ergot; identical with trehalose.
Melezitose.	Obtained from manna found in Tasmania and Persia.
Melitose.	Obtained from various species of Eucalyptus.
Trehalose.	Obtained from the cocoons of Larinus maculatus.

2. **Non-fermentable Sugars.**—These are sometimes termed *saccharoids*. Some of them have the chemical composition of glucose.

Mannite, $C_6H_{14}O_6$.	Obtained from Manna and many other plants.
Dulcite, $C_6H_{14}O_6$.	Also called Melampyrite. Obtained from Melampyrum nemorosum.
Eucalyn, $C_6H_{12}O_6$.	Produced in the fermentation of melitose.
Inosite, $C_6H_{12}O_6$.	Obtained from muscular flesh.
Quercitose, $C_6H_{12}O_6$.	By decomposing quercitrin with diluted sulphuric acid.
Sorbite, $C_6H_{12}O_6$.	From Sorbus aucuparia,—mountain-ash berries.
Erythromannite, $C_{12}H_{30}O_{12}$.	Obtained from Protococcus vulgaris, also called *Phycite.*
Isodulcite, $C_6H_{14}O_6$.	From quercitrin.
Pinite, $C_6H_{12}O_5$.	From Pinus Lambertiana.
Quercite, $C_6H_{12}O_5$.	Obtained from acorns.

Glucose, $C_6H_{12}O_6$, may be obtained from candied honey, from grapes, and from many other sources, but it is prepared from starch upon an immense scale by the action of very weak sulphuric acid. The term glucose is applied to the syrupy product of this process, while the name *grape-sugar* is applied to the solid product from the same source. The process is as follows. The corn is first soaked in warm water, and is then ground on specially-prepared stones with a stream of water. The meal is next passed into a trough, the bottom of which is made of fine bolting-cloth. Here the starch is washed through and led to large tanks, where it is allowed to settle. It is next beaten up with caustic soda to separate the gluten, and the starch is again allowed to settle in long shallow troughs. The starch, washed from all adhering alkali, is next beaten up with water into a cream, and conducted into the converting-tubs. Here the starch cream is treated with dilute sulphuric acid, and steam is allowed to bubble up through the mixture. This process of conversion, which is called "open conversion," is completed in about two hours. Another method is called "close conversion." The substances are enclosed in stout copper cylinders and subjected to the action of superheated steam. This process occupies about fifteen minutes. After conversion, the liquid is treated with marble-dust and animal charcoal. After neutralization, the liquid is filtered through cloth and animal charcoal, and is then conveyed to the vacuum-pan. When glucose syrup alone is desired, the process of conversion is stopped when the starch has disappeared, so that the syrup contains both glucose and dextrin, while, when solid grape-sugar is desired, the conversion is carried further to the change of dextrin into dextrose. Glucose can be obtained as a hydrate in small and laminated crystals from aqueous solution, and anhydrous in hard crystalline masses either from alcoholic solution or from very concentrated aqueous solution. It is less sweet than cane-sugar. It is also less soluble in water, and much more soluble in alcohol. It has the sp. gr. 1.54–1.57 when anhydrous. Strong mineral acids hardly act on grape-sugar, but destroy cane-sugar with facility. On the other hand, grape-sugar is destroyed by alkalies, with which cane-sugar forms definite compounds. Dissolved in water and subjected to prolonged ebullition, grape-sugar undergoes very little alteration. Its solution rotates the plane of polarization of polarized light to the right, and is capable of undergoing the vinous fermentation directly, without passing through any intermediate state. It is characterized, also, in boiling solution, by reducing alkaline cupric tartrate (see Test-Solution of Alkaline Cupric Tartrate), producing a reddish precipitate. Manufactured glucose may sometimes contain calcium sulphate, which

may be detected by adding a solution of barium chloride, which produces a white precipitate of barium sulphate.

SACCHARUM. *U. S.* Sugar.

$C_{12}H_{22}O_{11} = 341.2.$ [CANE SUGAR.]

The refined sugar obtained from *Saccharum officinarum* Linné, and from various species or varieties of *Sorghum* (nat. ord. *Gramineæ*); also from one or more varieties of *Beta vulgaris* Linné (nat. ord. *Chenopodiaceæ*).

Preparation.—Sugar is prepared commercially from the sugar-cane, beet-root, and sorghum. Formerly, sugar-cane was the only source; but at present the root of *Beta vulgaris* is largely used in Europe for making cane-sugar, and from the rapid growth of this industry there is a prospect of its supplanting all others. To prepare sugar the sugar-cane is crushed, and the juice, amounting to about 80 per cent., is expressed; this is then heated, a little lime and calcium bisulphite added, strained, and the liquid quickly evaporated, cooled, and stirred. The thick liquid is transferred to casks perforated at the bottom, and the crystals drained. Sugar made in this way is called "open pan" sugar. It is now almost completely displaced by "vacuum-pan" sugar.

In the production of raw sugars by the vacuum-pan process, the juice, after "defecation" with lime and removal of excess of lime by carbonic acid gas, is run through large filters of bone-black, and then into the vacuum-pan for concentration. The vacuum-pan is a large evaporating-pan, closed above by a dome-like top, which connects with an exhausting steam-pump, so that the liquid can be concentrated under very reduced pressure (see page 140). The heat is supplied by coils of steam-pipes which run through the interior of the pan. The saccharine juice is evaporated in this until it begins to crystallize, and even after this fresh portions are added, so that the crystals already formed grow by accretion of fresh material. After the crystallization is complete, the warm mixture of crystals and syrup is run into "centrifugals," to which a rapid revolution is given, and the crystals thus drained and dried.

Beet-root sugar is made in a similar manner, but is more troublesome to purify than that made from sugar-cane. The best sugar for pharmaceutical uses is known technically as "granulated." Loaf-sugar is generally pure, but if kept in a damp atmosphere it is liable to absorb moisture, and if kept in a very dry air it will lose weight. For making troches, *lozenge-sugar*, a very pure, finely-powdered sugar, may be had through dealers in confectioners' supplies. "*Pulverized*" *sugar*, as it is called, is unfitted for such a purpose.

Saccharum. U. S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
White, dry, hard, distinctly crystalline granules, permanent in the air. The aqueous solution, saturated at 15° C. (59° F.), has the sp. gr. 1.345, and is miscible with water in all proportions.	Odorless; purely sweet taste; neutral reaction.	At 15° C. (59° F.), 0.5 part. Boiling, 0.2 part.	At 15° C. (59° F.), 175 parts. Boiling, 28 parts.	Soluble in 80 parts of boiling absolute alcohol, but insoluble in ether, chloroform, or carbon disulphide.

IMPURITIES.	TESTS FOR IMPURITIES.
Insoluble Salts, Ultramarine, Prussian Blue, etc.	Neither an aqueous nor an alcoholic solution of Sugar, kept in large, well-closed and completely filled bottles, should deposit a sediment on prolonged standing.
Grape-Sugar, and more than a slight amount of Inverted Sugar.	If a portion or about 1 Gm. of Sugar be dissolved in 10 C.c. of boiling water, then mixed with 4 or 5 drops of silver nitrate T.S. and about 2 C.c. of ammonia water, and quickly heated until the liquid begins to boil, not more than a slight coloration, but no black precipitate, should appear in the liquid after standing at rest for five minutes.

When sugar is crystallized in regular large monoclinic prisms, it is called *rock-candy,* and has the sp. gr. 1.606. The official test excludes sugar which contains ultramarine; this is often added by refiners to save the expense of using bone-black: a sugar not entirely free from yellow color can be blued by ultramarine, and the fault thus covered up, so that most consumers remain ignorant of the deception; when solution is attempted, however, it is discovered, for the syrup is never colorless, and a sediment is deposited. Sugar in dilute aqueous solution is converted into alcohol, carbon dioxide, and eventually acetic acid, if exposed to warm air.

Cane-sugar may be distinguished from grape-sugar by Trommer's test, which consists in the use of copper sulphate and caustic potassa. If a solution of cane-sugar be mixed with a solution of copper sulphate, and potassa be added in excess, a deep blue liquid is obtained, which on being heated deposits, after a time, a little red powder. A solution of grape-sugar, similarly treated, yields, by heat, a copious greenish precipitate, which rapidly changes to scarlet, and eventually to dark red. When heated to 185° C. (365° F.), cane-sugar melts into a viscid, colorless liquid, which on being suddenly cooled forms a transparent amorphous mass, called *barley-sugar.* At a higher temperature (between 204.4° C. and 215.5° C. (400° F. and 420° F.) it loses two molecules of water, and is converted into a very thick, black liquid, called *caramel,* which is used largely for coloring aqueous or hydro-alcoholic liquids. At a still higher heat it yields combustible gases, carbonic acid, empyreumatic oil, and acetic acid, and there remains one-fourth of its weight of charcoal, which burns without residue.

Uses.—Sugar is used principally in pharmacy for making syrups, troches, masses, confections, etc., as already noted.

Saccharures are preparations made by saturating sugar with tinctures, drying it, and then reducing the mixture to a fine powder.

Oleo-saccharures (Elæosaccharа) are similar preparations made by incorporating one drop of a volatile oil with thirty grains of sugar: they form convenient modes of administering remedies to children.

MEL. *U.S.* Honey.

A saccharine secretion deposited in the honey-comb by *Apis mellifica* Linné (Class, *Insecta;* Order, *Hymenoptera*).

It is not known whether honey is secreted by the bee, or whether it exists ready formed in plants. The nectaries of flowers contain a

sweet substance, which is extracted by the insect. Large quantities of honey are obtained from California, the Southern States, and the West Indies. A still larger amount, however, is manufactured by flavoring and coloring artificial glucose. The official test ingeniously detects this adulteration through the barium chloride test. Artificial glucose nearly always contains a trace of calcium sulphate, which produces a slight precipitate of barium sulphate (see below).

Mel. *U.S.*	Odor and Taste.	Solubility.
A syrupy liquid of a light yellowish or pale brownish-yellow color, translucent when fresh, gradually becoming crystalline and opaque. When recent honey is diluted with 2 parts of water, the resulting liquid is almost clear, not stringy, and should have a specific gravity not lower than 1.100 (corresponding to a specific gravity of 1.375 for the original honey).	Characteristic aromatic odor; sweet, faintly acrid taste; faintly acid reaction.	Miscible with water and alcohol.

Impurities.	Tests for Impurities.
Limit of Chlorides.	If 1 part of Honey be dissolved in 4 parts of water, a clear or nearly clear solution should result, which should not be rendered more than faintly opalescent by a few drops of silver nitrate T.S.
Sulphate.	If 1 part of Honey be dissolved in 4 parts of water, a clear or nearly clear solution should result, which should not be rendered more than faintly opalescent by a few drops of barium chloride T.S.
Glucose and Foreign Inorganic Substances.	If 1 volume of Honey be diluted with 1 volume of water and a portion of this liquid gradually mixed with 5 volumes of absolute alcohol, it should not become more than faintly opalescent (as compared with the reserved portion of the solution), and should neither become opaque, nor deposit a slimy substance at the bottom and along the sides of the test-tube. When incinerated in small portions at a time, in a platinum crucible, it should not leave more than 0.2 per cent. of ash.
Starch.	Five parts of water boiled with 1 part of Honey, and allowed to cool, should not be rendered blue or green on the addition of iodine T.S.

Uses.—Honey is used pharmaceutically in the class Mellita (page 312), and as a vehicle and excipient. Owing to the difficulty of obtaining pure honey in large cities and towns, its place in many official preparations has been filled by substituting syrup or glycerin. Purified honey is official as Mel Despumatum (see page 313).

MANNA. *U.S.* Manna.

The concrete, saccharine exudation of *Fraxinus Ornus* Linné (Nat. Ord. *Oleaceæ*).

This substance, which is found in commerce of varying quality, is of a yellowish-white color externally; internally, white, porous, and crystalline. Its sp. gr. is 0.834. When pure, it is soluble in three parts of cold water and in its own weight of boiling water. It separates in crystalline masses from a boiling, saturated, aqueous solution. It is soluble in alcohol; boiling alcohol will dissolve fifteen per cent. of it, and upon cooling deposit beautiful crystals of mannite.

The principal constituent of manna is *mannite*, a peculiar, sweet principle, which is also found in many other plants.

Mannite is white, inodorous, crystallizable in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and de-

posited when it cools. Its composition is $C_6H_{14}O_6$, and it is considered as belonging to the class of *hexatomic alcohols*. It may be obtained by boiling manna in alcohol, allowing the solution to cool, and redissolving the crystalline precipitate: pure mannite is then deposited.

Uses.—Manna is used as a laxative, and often added to senna leaves to make a cathartic infusion. The dose is from one to two ounces (31 to 62 Gm.).

GLYCYRRHIZA. *U. S.* Glycyrrhiza.

[LIQUORICE ROOT.]

The root of *Glycyrrhiza glabra* Linné, and of the variety *glandulifera* (Waldstein et Kittaibel) Regel et Herder (nat. ord. *Leguminosæ*).

This well-known root contains the sweet principle *glycyrrhizin*, or *glycyrrhizic acid*, $C_{44}H_{63}NO_{18}$. This was found by Roussin to exist in the root in combination with ammonium. There is also present an oleoresinous substance which communicates to the root a slight acridity.

Uses.—Glycyrrhiza is valuable in pharmacy solely on account of the sweet principle. It is one of the most efficient substances known for masking the taste of bitter substances, like quinine sulphate, etc.

Official Preparations.

Extractum Glycyrrhizæ . . . . . Extract of Glycyrrhiza.	The commercial extract of the root, prepared by evaporating an aqueous extract and forming it into cylindrical rolls about six inches long (see page 450).
Extractum Glycyrrhizæ Purum . . Pure Extract of Glycyrrhiza.	Made by percolating glycyrrhiza with dilute solution of ammonia and evaporating the percolate to a pilular consistence (see page 450).
Pulvis Glycyrrhizæ Compositus . . Compound Powder of Glycyrrhiza.	Made by mixing together 180 Gm. senna, 236 Gm. glycyrrhiza, 4 Gm. oil of fennel, 80 Gm. washed sulphur, and 500 Gm. sugar, all in fine powder.
Extractum Glycyrrhizæ Fluidum . Fluid Extract of Glycyrrhiza.	Made of the strength of 1 C.c. representing 1 Gm., with a menstruum consisting of 50 C.c. ammonia water, 300 C.c. alcohol, and 650 C.c. water (see page 408).

GLYCYRRHIZINUM AMMONIATUM. *U. S.* Ammoniated Glycyrrhizin.

	Metric.	Old form.
Glycyrrhiza, in No. 20 powder	500 Gm.	25 oz. av.
Water,		
Ammonia Water,		
Sulphuric Acid, each, a sufficient quantity.		

Mix 475 C.c. [old form 11 fl. oz. 192 min.] of Water with 25 C.c. [old form 288 min.] of Ammonia Water, and, having moistened the powder with the mixture, macerate for twenty-four hours. Then pack it moderately in a conical glass percolator, and gradually pour Water upon it until 500 C.c. [old form 12 fl. oz.] of percolate are obtained. Add Sulphuric Acid slowly to the percolate, with constant stirring, so long as a precipitate is produced. Collect this on a strainer, wash it with cold Water until the washings no longer have an acid reaction, redissolve it in Water with the aid of Ammonia Water, filter, if necessary, and again add Sulphuric Acid so long as a precipitate is produced. Collect this, wash it, dissolve it in a sufficient quantity of Ammonia Water previously diluted with an equal volume of Water, and spread the clear solution upon plates of glass, so that, when dry, the product may be obtained in scales.

The introduction of this preparation is the result of the very important researches of Z. Roussin, who noticed that *glycyrrhizin*, the sweet principle of liquorice root, was insipid when compared with the root itself, and inferred that it existed in a modified form in the root. Experiment showed that alkalies developed the sweet taste, and he ultimately proved that the alkali with which it was combined in the root was ammonia, and that glycyrrhizin played the part of an acid. Liquorice root which has lost a portion of its sweetness through fermentation and the development of acetic acid and precipitation of insoluble glycyrrhizin can be restored to its former sweetness if allowed to remain a sufficient length of time in an ammoniacal atmosphere.

Uses.—This compound is useful when mixed with bitter or disagreeable powders to mask their taste.

TRITICUM. *U. S.* Triticum. [Couch-grass.]

The rhizome of *Agropyrum repens* (Linné) Beauvois (nat. ord. *Gramineæ*), gathered in the spring and deprived of the roots.

Triticum is usually found in the market cut into small sections. It contains *triticin*, a principle resembling inulin, also glucose, lævulose, etc. It is used as a diuretic and for its special action on the urinary organs.

Official Preparation.

Extractum Tritici Fluidum . . **Fluid Extract of Triticum.**	Made with boiling water, concentrated by evaporation, and preserved by the addition of a mixture of 1 volume of alcohol and 3 volumes of water (see page 426).

QUESTIONS ON CHAPTER LI.

SUGARS AND SACCHARINE SUBSTANCES.

What are sugars?
To what is the term sugar popularly applied?
Into what two classes may sugars be divided?
Into what two sub-classes may fermentable sugars be conveniently divided?
What are glucoses, and what are saccharoses?
What are the non-fermentable sugars sometimes called?
Glucose—What is its formula in symbols?
How is it obtained on the large scale?
Is glucose more or less sweet than cane-sugar?
What is its specific gravity when anhydrous?
Wherein does the action of strong mineral acids and of alkalies upon glucose differ from their action upon cane-sugar?
In what direction does its solution rotate the plane of polarization of polarized light?
Is it capable of direct fermentation?
What effect has it in boiling solution upon alkaline cupric tartrate?
What impurity does it almost always contain?
How may this be detected?
Sugar—What is the Latin name?
Give its formula in symbols and molecular weight.
How is it prepared commercially?
What is the difference between the "open pan process" and the "vacuum process"?

What is the best sugar for pharmaceutical purposes?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Insoluble salts, foreign matters, ultramarine, Prussian blue, etc.; grape-sugar, and of more than a slight amount of inverted sugar.
What is the specific gravity of rock-candy?
What is the object of adding ultramarine to sugar?
What change takes place when sugar in dilute solution is exposed to warm air?
When cane-sugar is heated to 185° C. (365° F.), what change takes place, and what is formed?
At a higher temperature, 204.4° to 215.5° C. (400° to 420° F.), what change takes place?
At a still higher temperature what occurs?
For what purposes in pharmacy is sugar used?
What are saccharures?
What are oleo-saccharures (elæosacchara)?
Honey—Whence is it obtained?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Chloride; sulphate; glucose or other foreign admixtures; starch.
For what is honey used in pharmacy?
In what form is it official?
What is manna? What is its specific gravity?
What is its solubility in water? In alcohol?
What is the principal constituent of manna?
What are the physical properties of mannite?
What is its chemical composition, and to what class is it considered to belong?
How may it be obtained?
For what is manna used, and what is the dose?
Liquorice root—What is the Latin official name? Whence obtained?
What sweet principle does glycyrrhiza contain?
What is its chemical composition, and in what combination does it exist in the root?
To what does the root owe its acridity?
What are the official preparations of glycyrrhiza?
Ammoniated glycyrrhizin—What is the Latin official name?
How is it made?
What amount is obtained from glycyrrhiza?
What effect do alkalies have upon glycyrrhizin?
For what is this compound useful?
What is triticum, and how is it found in commerce?
What principles does triticum contain?
For what is it used?
What official preparation of triticum is there?

CHAPTER LII.

DERIVATIVES OF SUGARS THROUGH THE ACTION OF FERMENTS.

Fermentation.—When certain organic bodies are subjected to the action of water, air, and a warm temperature, decomposition takes place. This is accompanied by the presence of microscopic organisms, and the result is the formation of new products. When decomposition is followed by the production of worthless or offensive substances, it is termed *putrefaction;* when useful products are formed, the process is called *fermentation.*

Two prominent theories accounting for the phenomena of fermentation have been advanced,—one, in which the action is regarded as a chemical process, the presence of the microscopic bodies being considered unimportant; the other (which is now universally accepted) that fermentation is caused by the presence of the organisms.

Ferments may be divided into two classes: 1. Organized or physiological ferments, as yeast, mycoderms, torulas, etc.; 2. Unorganized or soluble nitrogenous ferments, like diastase, synaptase, myrosin, etc. Fermentation which is produced by the latter class has been termed *false fermentation*, and the ferments themselves called *cryptolytes.*

Vinous Fermentation.—Cane-sugar, as before stated, is capable of being decomposed by this process and converted into alcohol and carbon dioxide, but it will not undergo the vinous fermentation by itself. It requires to be dissolved in water, subjected to the influence of a ferment, and kept at a certain temperature. Accordingly, sugar, water, the presence of a ferment, and the maintenance of an adequate temperature must be deemed the prerequisites of the vinous fermentation. The water acts by giving fluidity, and the ferment and temperature by commencing and maintaining the chemical changes. The precise manner in which the ferment operates has not been positively determined; but the fermentative change seems to be intimately connected with the multiplication of a microscopic plant, *Torula cerevisiæ.*

Beginning with the simple substances cellulose and starch, it will be found that, through the action of dilute acids and ferments, they may be converted into alcohol or acetic acid:

$$\underset{\text{Cellulose or Starch.}}{(C_6H_{10}O_5)_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5};$$

then

$$\underset{\text{Maltose.}}{C_{12}H_{22}O_{11}} + \underset{\text{Starch.}}{C_6H_{10}O_5} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Glucose.}}{(C_6H_{12}O_6)_3};$$

then

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} = \underset{\text{Alcohol.}}{(C_2H_5HO)_2} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

And if the action is not arrested, the acetous fermentation begins, resulting in the conversion of the alcohol into acetic acid through oxidation:

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Acetic Acid.}}{C_2H_4O_2} + \underset{\text{Water.}}{H_2O}.$$

The most important derivative of sugar through the action of a ferment is alcohol: this is usually obtained from whisky by distillation. The distilled product of vinous liquors forms the different ardent spirits of commerce. When obtained from wine, it is called *brandy;* from fermented molasses, *rum;* from cider, malted barley, or rye, *whiskey;* from malted barley and rye-meal with hops, and rectified from juniper berries, *Holland gin;* from malted barley, rye, or potatoes, and rectified from turpentine, *common gin;* and from fermented rice, *arrack.* These spirits are of different strengths,—that is, contain different proportions of alcohol,—and have various peculiarities by which they are distinguished by the taste.

The compounds derived from sugars will be considered under the following subheads: 1. Ethyl hydrate and oxide and their preparations. 2. Preparations of the compound ethers of the ethyl and amyl series. 3. Aldehyd, its derivatives and preparations.

Ethyl Hydrate and Oxide and their Preparations.

The compounds containing the radical ethyl are the most important of those derived from organic substances, alcohol being the source of all.

Alcohol is regarded chemically as the type of a class of carbon compounds called alcohols, of which there are many important members. *They are the hydrates of the alcohol radicals* (ethyl hydrate, alcohol; amyl hydrate, amylic alcohol), just as slaked lime, or calcium hydrate, is the hydrate of the metal calcium.

Ethers are the *oxides of these radicals,* just as lime, or calcium oxide, is the oxide of the metal calcium.

Compound ethers are analogous to the salts of the metals, being formed by the decomposition of their alcohols by acids,—*i.e.*, ethyl nitrite, ethyl acetate, amyl nitrite,—just as potassium nitrate, sodium acetate, and calcium sulphate may be produced by decomposing the hydrates of their respective metals with acids. In each case water is formed as one of the results of the decomposition.

This may be shown by the reactions

$$\underset{\text{Sodium Hydrate.}}{NaHO} + \underset{\text{Acetic Acid.}}{C_2H_4O_2} = \underset{\text{Sodium Acetate.}}{NaC_2H_3O_2} + \underset{\text{Water.}}{H_2O}.$$

$$\underset{\text{Alcohol or Ethyl Hydrate.}}{C_2H_5HO} + \underset{\text{Acetic Acid.}}{C_2H_4O_2} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\text{Water.}}{H_2O}.$$

SPIRITUS FRUMENTI. *U.S.* Whiskey.

An alcoholic liquid, obtained by the distillation of the mash of fermented grain (usually of mixtures of corn, wheat, and rye), and at least two years old.

Owing to the immense production of grain in this country, the cheapest sources of starch (corn, wheat, and rye) are used in making alcoholic liquids. The operations by which whiskey is obtained from grain are technically termed,—1. *Mashing*, by which the starch is converted into sugar. 2. *Fermentation*, or the production of the alcohol. 3. *Distillation*, or the separation of the crude spirit.

The crushed grain, mixed with malt, is added to water at 15.4° C. (60° F.), and allowed to stand, to permit the conversion of the starch into maltose, through the action of the diastase. The liquid is now termed the *wort*. This is caused to ferment by the addition of yeast, and alcohol is gradually formed, carbon dioxide escaping: the liquor is then distilled, the distillate being termed *low wines*. This is again distilled, and *raw whiskey* is the product. This upon keeping, especially in a warm room, improves in quality through the formation of compound ethers, which are supposed to communicate an agreeable flavor to the liquid.

Spiritus Frumenti. *U.S.*	Impurities.	Tests for Impurities.
Whiskey has an amber color, a distinctive taste and odor, slightly acid reaction, and a sp. gr. not above 0.930 nor below 0.917, corresponding approximately with an alcoholic strength of 44 to 50 per cent. by weight, or 50 to 58 per cent. by volume.	Limit of Free Acid.	To render 100 C.c. of Whiskey distinctly alkaline to litmus should not require more than 1.2 C.c. of potassium hydrate V.S.
	More than traces of Fusel Oil from grain.	If 100 C.c. of Whiskey be very slowly evaporated in a tared capsule on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor,
	Added Sugar, Glycerin, or Aromatic Substances.	And the residue, when dried at 100° C. (212° F.), should not weigh more than 0.25 Gm. This residue should have no sweet or distinctly spicy taste.
	More than traces of Oak Tannin from casks.	It should almost completely dissolve in 10 C.c. of cold water, forming a solution which is colored not deeper than light green by a few drops of dilute ferric chloride T.S., made by mixing the latter with 10 volumes of water.

Uses.—Crude whiskey is used as the source of alcohol. When purified and mellowed by age, it is used as a stimulant.

ALCOHOL. *U.S.* Alcohol.

A liquid composed of about 91 per cent., by weight, or 94 per cent., by volume, of Ethyl Alcohol [$C_2H_5OH = 45.9$], and about 9 per cent., by weight, of Water.

ALCOHOL ABSOLUTUM. *U.S.* Absolute Alcohol.

$$C_2H_5OH = 45.9.$$

Ethyl Alcohol, containing not more than 1 per cent., by weight, of Water. Absolute Alcohol should be kept in well-stoppered bottles or tin cans, in a cool place, remote from lights or fire.

ALCOHOL DEODORATUM. Deodorized Alcohol.

A liquid composed of about 92.5 per cent., by weight, or 95.1 per cent., by volume, of Ethyl Alcohol [$C_2H_5OH = 45.9$], and about 7.5 per cent., by weight, of Water.

Preparation.—The natural sources of alcohol are starch and sugar as they exist in various plants, and alcohol, if pure, is the same from whatever source it is derived. It is generally made by distilling whiskey, and redistilling and rectifying the distillate in an apparatus termed an alcohol column and still. The yield of alcohol, sp. gr. .835, obtained from good whiskey is about 58 per cent. by volume. The principal impurity is *fusel oil*, or amylic alcohol. Alcohol may be deprived of odor by treating it with potassium permanganate and redistilling. *Absolute alcohol* is the name given to the strongest alcohol which can be made, and which is intended to be absolutely free from water. This is a difficult preparation to make, owing to the very strong affinity existing between the two liquids. The strongest alcohol that can be made by simple distillation contains 11 per cent. of water, and in order to separate the latter from it, it is necessary to use some substance having a still stronger affinity for water. This is found in recently-burned lime, and the method employed is to percolate the strongest and purest alcohol attainable through the lime, out of contact with air, and then to redistil the percolate in vacuo. In this way alcohol may be obtained having a sp. gr. as low as 0.79355 at 15.6° C. (60° F.). (Squibb.) Absolute alcohol is a colorless, volatile liquid, of an agreeable odor and a burning taste. It boils at 78.4° C. (173.1° F.), and is not congealed by a cold of 202° F. below zero. Its freedom from water may be ascertained by dropping into it a piece of anhydrous baryta, which will remain unchanged if the alcohol be free from water, but otherwise will fall to powder; or (a more delicate test) by its forming a clear solution when mixed with an equal bulk of pure benzol. Absolute alcohol should be free from fusel oil.

Alcohol. *U. S.*	Impurities.	Tests for Impurities.
A transparent, colorless, mobile, and volatile liquid, of a characteristic and agreeable odor, and a burning taste. It boils at 78° C. (172.4° F.), and is readily inflammable, giving a blue flame without smoke. It should not change the color of blue or red litmus paper previously moistened with water.	Fixed Impurities, or Coloring-Matter.	If 50 C.c. of Alcohol be evaporated to dryness in a glass vessel, no weighable residue or color should appear.
	Fusel Oil, or other Foreign Odor.	On allowing Alcohol, mixed with one-third of its volume of water, to evaporate spontaneously from clean, odorless blotting-paper saturated with it, no odor of fusel oil, nor other foreign odor, should become perceptible.
	Amylic Alcohol, Organic impurities.	If 20 C.c. of Alcohol be shaken in a clean, glass-stoppered vial with 1 C.c. of silver nitrate T.S., the mixture should not become more than faintly opalescent, or acquire more than a faint brownish tint, when standing during six hours in diffused daylight.
Miscible with water in all proportions, and without any trace of cloudiness; also miscible with ether or chloroform.	Methyl Alcohol, Aldehyde, and Oak Tannin.	If 10 C.c. of Alcohol be mixed in a test-tube with 5 C.c. of potassium hydrate T.S., there should not be an immediate darkening of the liquid.

It burns with a pale flame without residue, the products being carbonic acid and water. Absolute alcohol consists of two atoms of carbon, six of hydrogen, and one of oxygen. Its empirical formula is, therefore, C_2H_6O. It is, however, recognized as the hydrate of the radical ethyl (C_2H_5), so that its rational formula would be C_2H_5HO.

Alcohol is official in four forms: absolute alcohol, sp. gr. 0.797; deodorized alcohol, sp. gr. 0.816; alcohol, sp. gr. 0.820 at 15° C. (59° F.), 0.812 at 25° C. (77° F.); diluted alcohol, sp. gr. 0.936.

Deodorized alcohol is merely a stronger and higher grade of alcohol, and, according to the U. S. P. 1890, must stand the following tests: If 25 C.c. of Deodorized Alcohol be mixed with an equal volume of water and 5 C.c. of glycerin, and the mixture allowed to evaporate spontaneously from a piece of clean, odorless blotting paper, no foreign odor should become perceptible when the last traces of Alcohol leave the paper (absence of *fusel oil constituents*). If 25 C.c. be allowed to evaporate spontaneously in a porcelain capsule carefully protected from dust, until only a moisture is left, no red or brown color should be produced upon the addition of a few drops of colorless, concentrated sulphuric acid (absence of *amylic alcohol*, or *non-volatile, carbonizable, organic impurities*).

The official description and tests for Absolute Alcohol are as follows: A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Very hygroscopic. Specific gravity: not higher than 0.797 at 15° C. (59° F.); or 0.789 at 25° C. (77° F.). In other respects, Absolute Alcohol has the properties, and should respond to the reactions and tests, of Deodorized Alcohol (see *Alcohol Deodoratum*).

Uses.—Alcohol is used in pharmacy principally for its solvent powers (see pages 355, 356). It is used as the source of many important compounds, like ether, chloroform, iodoform, etc., and as an antiseptic. The cologne spirit is generally a purified product, and cleaner than ordinary alcohol. A specially fine brand of alcohol can now be had which is rectified particularly for perfumers' use: it is said to be made by diluting the cologne spirit with sufficient water to bring it to about the strength of diluted alcohol, passing this through bone-black, and then redistilling and concentrating it again to the proper strength in the rectifying column and still.

ALCOHOL DILUTUM. *U. S.* Diluted Alcohol.

A liquid composed of about 41 per cent., by weight, or about 48.6 per cent., by volume, of absolute Ethyl Alcohol [$C_2H_5OH = 45.9$], and about 59 per cent. of Water. It should be kept in well-closed vessels, in a cool place, remote from lights or fire.

	Metric.	Old form.
Alcohol	500 C.c.	1 pint.
Distilled Water	500 C.c.	1 pint.

Mix them. If the two liquids be measured at the temperature of 15.6° C. (60° F.), the mixture, when cooled to the same temperature, will measure about 971 C.c.

Diluted Alcohol may also be prepared in the following manner:

	Metric.	Old form.
Alcohol	410 Gm.	41 oz. av.
Distilled Water	500 Gm.	50 oz. av.

Mix them.

Diluted Alcohol has a specific gravity of about 0.938 at 15° C. (59° F.), about 0.937 at 15.6° C. (60° F.), and about 0.930 at 25° C. (77° F.).

It should respond to the reactions and tests given under *Alcohol.*[1]

When alcohol and water are mixed together, a rise in temperature and a contraction in volume take place. In small operations the contraction is generally disregarded; in larger operations the loss is very apparent. If 55 gallons of alcohol be mixed with 45 gallons of water, the product will not be 100 gallons of diluted alcohol, but only 96¼ gallons, showing a loss of 3¾ gallons. United States *Proof Spirit* differs from diluted alcohol in containing 50 per cent. *by volume* of absolute alcohol.

Uses.—Diluted alcohol is used as a menstruum in making tinctures, fluid extracts, extracts, etc. Its properties have been already fully described in connection with the various preparations. Its value consists not only in antiseptic properties, but also in its possessing the solvent powers of both water and alcohol.

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[1] *Official Rules for making an Alcohol of any Required Lower Percentage from an Alcohol of any Given Higher Percentage.*—I. BY VOLUME: Designate the volume-percentage of the stronger alcohol by V, and that of the weaker alcohol by v. Rule: Mix v volumes of the stronger alcohol with pure water to make V volumes of product. Allow the mixture to stand until full contraction has taken place, and until it has cooled, then make up any deficiency in the V volumes by adding more water. Example: An alcohol of 30 per cent. by volume is to be made from an alcohol of 94 per cent. by volume.—Take 30 volumes of the 94 per cent. alcohol, and add enough pure water to produce 94 volumes.

II. BY WEIGHT: Designate the weight-percentage of the stronger alcohol by W, and that of the weaker by w. Rule: Mix w parts by weight of the stronger alcohol with pure water to make W parts by weight of product. Example: An alcohol of 50 per cent. by weight is to be made from an alcohol of 91 per cent. by weight.—Take 50 parts by weight of the 91 per cent. alcohol, and add enough pure water to produce 91 parts by weight.

It is evident that when percentage by volume is specified the liquids should be *measured*, and when percentage by weight is used the liquids in all cases should be *weighed*. The alcoholmetrical table gives the various percentages *both* by *weight* and *volume*, and an examination will show clearly that there is considerable difference between weight and volume percentage. When alcohol is sold by per cent. valuation, unscrupulous dealers sometimes take advantage of the unwary when the buyer does not specify whether he wants "per cent. by volume" or per cent. by weight. It is much more satisfactory in buying alcohol to indicate clearly the strength that is wanted by inserting the specific gravity at the official temperature: thus, an order for "Alcohol, sp. gr. 0.820 at 59° F.," cannot be susceptible of two meanings.

Pile's Rules for Diluting Alcohol.—1. To reduce alcohol to any required strength. To as many parts of the given alcohol as are indicated by the percentage required, add sufficient water to make the number of parts of the mixture equal to the percentage of the given alcohol. Example: It is desired to make an alcohol of 30 per cent. from one of 95 per cent. Take 30 fluidounces of the alcohol and add a sufficient amount of water to make 95 fluidounces.

2. To make any required quantity of any per cent. As the percentage of the alcohol given is to that of the alcohol required, so is the quantity desired to the quantity of the alcohol to be taken. And to this quantity of alcohol sufficient water must be added to make up the required quantity. Example: It is desired to make 80 fluidounces of 75 per cent. alcohol from that of 95 per cent. As 95 : 75 : : 80 : 63$\frac{3}{19}$. This represents the number of fluidounces of 95 per cent. alcohol that is to be made up to 80 fluidounces by the addition of water.

By these rules no allowance is made for any subsequent contraction, and a mixture after being made should be allowed to stand for a short time for such contraction to take place, when a final amount of water is to be added to make up the full measure.

ALCOHOLMETRICAL TABLE.

Based on the Relation between Absolute Alcohol (Sp. Gr. 0.7938) and Pure Water at 15.6° C. (60° F.).—Abridged from Dr. E. R. Squibb's Table.

Percentage.		Specific Gravity.	Weight of One Pint.		Weight of One Gallon, Avoirdupois.			Percentage.		Specific Gravity.	Weight of One Pint.		Weight of One Gallon, Avoirdupois.		
By wt.	By vol.		In Gms.	In Grs.	Lbs.	Oz.	Grs.	By wt.	By vol.		In Gms.	In Grs.	Lbs.	Oz.	Grs.
		1.0000	472.39	7290	8	5	132		31	0.9643	455.53	7030	8	0	238
	1	0.9985	471.68	7279	8	5	44	26		0.9638	455.30	7026	8	0	209
1		0.9981	471.49	7276	8	5	22		32	0.9631	454.96	7021	8	0	168
	2	0.9970	470.98	7268	8	4	395	27		0.9623	454.58	7015	8	0	121
2		0.9965	470.74	7264	8	4	366		33	0.9618	454.35	7011	8	0	92
	3	0.9956	470.31	7258	8	4	313	28	34	0.9609	453.93	7005	8	0	40
3		0.9947	469.89	7251	8	4	261			0.9602	453.59	7000	7	15	436
	4	0.9942	469.66	7248	8	4	232			0.9595	453.26	6995	7	15	395
4	5	0.9930	469.09	7239	8	4	162	29	35	0.9593	453.17	6993	7	15	383
5	6	0.9914	468.33	7227	8	4	68			0.9587	452.88	6989	7	15	348
6	7	0.9898	467.58	7216	8	3	413	30	36	0.9578	452.46	6982	7	15	296
	8	0.9890	467.19	7210	8	3	366			0.9572	452.18	6978	7	15	261
7		0.9884	466.91	7205	8	3	331		37	0.9565	451.84	6973	7	15	220
	9	0.9878	466.63	7201	8	3	296	31		0.9560	451.61	6969	7	15	191
8	10	0.9869	466.21	7194	8	3	243			0.9555	451.38	6966	7	15	162
9	11	0.9855	465.54	7184	8	3	161		38	0.9550	451.14	6962	7	15	133
10	12	0.9841	464.89	7174	8	3	81	32		0.9544	450.86	6958	7	15	98
11	13	0.9828	464.27	7165	8	3	5			0.9539	450.61	6954	7	15	68
	14	0.9821	463.94	7159	8	2	401		39	0.9535	450.43	6951	7	15	45
12	15	0.9815	463.65	7155	8	2	366	33		0.9528	450.09	6946	7	15	4
13	16	0.9802	463.04	7146	8	2	290		40	0.9519	449.67	6939	7	14	390
		0.9794	462.67	7140	8	2	244	34		0.9511	449.29	6933	7	14	343
14	17	0.9789	462.42	7136	8	2	214		41	0.9503	448.91	6928	7	14	296
		0.9784	462.19	7132	8	2	185			0.9495	448.54	6922	7	14	250
15	18	0.9778	461.90	7128	8	2	150	35	42	0.9490	448.30	6918	7	14	221
		0.9775	461.77	7126	8	2	128			0.9475	447.59	6907	7	14	133
		0.9772	461.62	7124	8	2	115	36	43	0.9470	447.36	6904	7	14	104
16	19	0.9766	461.34	7119	8	2	80			0.9465	447.12	6900	7	14	75
	20	0.9760	461.05	7115	8	2	45	37	44	0.9452	446.51	6890	7	13	437
17	21	0.9753	460.72	7110	8	2	4			0.9446	446.22	6886	7	13	401
		0.9749	460.54	7107	8	1	418	38	45	0.9434	445.66	6877	7	13	331
		0.9743	460.25	7103	8	1	383			0.9426	445.28	6871	7	13	284
18	22	0.9741	460.16	7101	8	1	373	39	46	0.9416	444.81	6864	7	13	226
		0.9737	459.97	7098	8	1	348			0.9405	444.29	6856	7	13	162
		0.9732	459.73	7095	8	1	319	40	47	0.9396	443.86	6850	7	13	109
19	23	0.9728	459.55	7092	8	1	297			0.9391	443.62	6846	7	13	75
		0.9720	459.16	7086	8	1	249		48	0.9381	443.15	6839	7	13	22
20	24	0.9716	458.98	7083	8	1	227	41		0.9376	442.92	6835	7	12	431
		0.9714	458.88	7081	8	1	214			0.9373	442.77	6833	7	12	413
	25	0.9709	458.65	7078	8	1	186		**49**	**0.9362**	**442.25**	**6825**	**7**	**12**	**349***
21		0.9704	458.41	7074	8	1	157	42		0.9356	441.97	6820	7	12	314
	26	0.9698	458.13	7070	8	1	122			0.9352	441.78	6818	7	12	291
		0.9693	457.90	7066	8	1	92		50	0.9343	441.35	6811	7	12	238
22	27	0.9691	457.80	7065	8	1	81	43		0.9335	440.98	6805	7	12	192
		0.9683	457.42	7059	8	1	33			0.9329	440.70	6801	7	12	157
23	28	0.9678	457.18	7055	8	1	5		51	0.9323	440.42	6796	7	12	122
		0.9671	456.85	7050	8	0	401			0.9318	440.18	6793	7	12	93
24	29	0.9665	456.57	7046	8	0	366	44		0.9314	439.99	6790	7	12	69
		0.9658	456.24	7041	8	0	325			0.9306	439.61	6784	7	12	23
25	30	0.9652	455.95	7036	8	0	290		52	0.9303	439.47	6782	7	12	5
		0.9645	455.63	7031	8	0	250	45		0.9292	438.95	6774	7	11	379

* Official diluted alcohol.

ALCOHOLMETRICAL TABLE.—(Continued.)

Percentage.		Specific Gravity.	Weight of One Pint.		Weight of One Gallon, Avoirdupois.			Percentage.		Specific Gravity.	Weight of One Pint.		Weight of One Gallon, Avoirdupois.		
By wt.	By vol.		In Gms.	In Grs.	Lbs.	Oz.	Grs.	By wt.	By vol.		In Gms.	In Grs.	Lbs.	Oz.	Grs.
	53	0.9283	438.52	6767	7	11	326		79	0.8664	409.28	6316	7	3	216
46		0.9270	437.91	6758	7	11	251	73		0.8649	408.57	6305	7	3	129
	54	0.9262	437.53	6752	7	11	204		80	0.8639	408.10	6298	7	3	71
47		0.9249	436.92	6742	7	11	128	74		0.8625	407.44	6288	7	2	426
	55	0.9242	436.58	6737	7	11	87		81	0.8611	406.78	6277	7	2	344
		0.9236	436.30	6733	7	11	51	75		0.8603	406.40	6272	7	2	298
48		0.9228	435.93	6727	7	11	6			0.8599	406.21	6269	7	2	274
	56	0.9221	435.60	6722	7	10	402	76	82	0.8581	405.36	6255	7	2	169
		0.9212	435.17	6715	7	10	349			0.8566	404.65	6245	7	2	82
49		0.9206	434.88	6711	7	10	314	77	83	0.8557	404.22	6238	7	2	29
	57	0.9200	434.60	6707	7	10	279			0.8539	403.38	6225	7	1	361
50		0.9184	433.85	6695	7	10	186	78		0.8533	403.09	6220	7	1	327
	58	0.9178	433.56	6691	7	10	151		84	0.8526	402.77	6215	7	1	287
51	59	0.9160	432.71	6678	7	10	46			0.8516	402.29	6208	7	1	227
		0.9150	432.24	6670	7	9	425	79		0.8508	401.92	6202	7	1	182
52	60	0.9135	431.53	6659	7	9	338		85	0.8496	401.35	6194	7	1	112
		0.9124	431.01	6651	7	9	278	80		0.8483	400.73	6184	7	1	36
53	61	0.9113	430.49	6643	7	9	210		86	0.8466	399.93	6172	7	0	374
		0.9100	429.88	6634	7	9	138	81		0.8459	399.60	6167	7	0	333
54	62	0.9090	429.41	6627	7	9	76	82	87	0.8434	398.42	6148	7	0	187
		0.9075	428.69	6616	7	8	425			0.8415	397.52	6134	7	0	76
55	63	0.9069	428.41	6611	7	8	390	83	88	0.8408	397.19	6129	7	0	35
		0.9062	428.09	6606	7	8	350			0.8396	396.62	6121	6	15	402
56	64	0.9047	427.37	6595	7	8	262	84		0.8382	395.96	6110	6	15	322
		0.9036	426.86	6587	7	8	198		89	0.8373	395.53	6104	6	15	269
57	65	0.9025	426.34	6579	7	8	134	85		0.8357	394.78	6092	6	15	176
58	66	0.9001	425.20	6562	7	7	432		90	0.8340	393.98	6080	6	15	77
59		0.8979	424.17	6546	7	7	304			0.8336	393.79	6077	6	15	53
	67	0.8973	423.88	6541	7	7	269	86		0.8331	393.55	6073	6	15	24
		0.8966	423.55	6536	7	7	227			0.8317	392.89	6063	6	14	380
60		0.8956	423.07	6529	7	7	169	87	91	0.8305	392.33	6054	6	14	310
	68	0.8949	422.75	6524	7	7	129			0.8298	391.99	6049	6	14	269
61		0.8932	421.94	6511	7	7	29	88		0.8279	391.09	6035	6	14	158
	69	0.8925	421.62	6506	7	6	426		92	0.8272	390.76	6030	6	14	117
		0.8910	420.90	6495	7	6	338			0.8259	390.14	6021	6	14	41
62		0.8908	420.81	6494	7	6	326	89		0.8254	389.91	6017	6	14	12
	70	0.8900	420.43	6488	7	6	280		93	0.8237	389.11	6005	6	13	351
		0.8897	420.29	6486	7	6	262	90		0.8228	388.69	5998	6	13	299
63		0.8886	419.77	6478	7	6	198	**91**	**94**	**0.8199**	**387.32**	**5977**	**6**	**13**	**130***
	71	0.8875	419.25	6470	7	6	134	92		0.8172	386.04	5957	6	12	409
64		0.8863	418.68	6461	7	6	64		**95**	**0.8164**	**385.66**	**5951**	**6**	**12**	**362†**
	72	0.8850	418.07	6452	7	5	426	93		0.8145	384.77	5938	6	12	252
65		0.8840	417.60	6444	7	5	368		96	0.8125	383.82	5923	6	12	135
	73	0.8825	416.88	6433	7	5	279	94		0.8118	383.49	5918	6	12	94
66		0.8816	416.46	6427	7	5	228	95		0.8089	382.12	5897	6	11	363
	74	0.8799	415.66	6414	7	5	129		97	0.8084	381.88	5893	6	11	334
67		0.8793	415.38	6410	7	5	94	96		0.8061	380.79	5876	6	11	200
68	75	0.8769	414.25	6393	7	4	391		98	0.8041	379.85	5862	6	11	83
69	76	0.8745	413.11	6375	7	4	251	97		0.8031	379.38	5855	6	11	25
		0.8739	412.83	6371	7	4	216	98		0.8001	377.96	5833	6	10	287
70	77	0.8721	411.98	6358	7	4	111		99	0.7995	377.68	5828	6	10	252
71	78	0.8696	410.79	6339	7	3	408	99		0.7969	376.45	5809	6	10	100
		0.8678	409.94	6326	7	3	297			0.7946	375.87	5793	6	9	404
72		0.8672	409.66	6322	7	3	263	100	100	0.7938	374.98	5787	6	9	357

* Official alcohol.

† Official deodorized alcohol.

ÆTHER. *U. S.* **Ether.** [ÆTHER FORTIOR, PHARM. 1880.]

A liquid composed of about 96 per cent., by weight, of absolute Ether or Ethyl Oxide [$(C_2H_5)_2O = 73.84$], and about 4 per cent. of Alcohol containing a little Water.

But one ether is now official, in place of the two in the U. S. P. 1880, known as Æther and Æther Fortior; the old Æther, sp. gr. 0.750, was dropped altogether, the name Æther being now applied to what was formerly known as Æther Fortior, or stronger ether.

Preparation.—The Pharmacopœia of 1870 contained a process for the preparation of Ether. It was rarely or never used, because this is one of the liquids which cannot be safely or profitably made upon the small scale with the usual facilities afforded by the pharmacist's laboratory. Ether is made by acting on alcohol with sulphuric acid between the temperatures of 130° C. (266° F.) and 137.7° C. (280° F.). The sulphuric acid is not consumed in the process, but is regenerated, so that the making of ether is continuous. This will be understood when the reactions are explained. Ether is the oxide of the monad radical ethyl C_2H_5. Alcohol, as has been already stated, is the hydrate C_2H_5HO: now,

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Sulphuric Acid.}}{H_2SO_4} = \underset{\text{Ethyl-sulphuric Acid.}}{C_2H_5HSO_4} + \underset{\text{Water.}}{H_2O};$$

then

$$\underset{\text{Ethyl-sulphuric Acid.}}{C_2H_5HSO_4} + \underset{\text{Alcohol.}}{C_2H_5HO} = \underset{\text{Ether.}}{(C_2H_5)_2O} + \underset{\text{Sulphuric Acid.}}{H_2SO_4}.$$

Formerly it was believed that the sulphuric acid acted by catalysis, and that it dehydrated the alcohol through its affinity for water; but, the presence of ethyl-sulphuric acid, which was formed during the process, having been proved, this simple theory had to be abandoned.

Æther. *U. S.*	ODOR, TASTE, AND REACTION.	SOLUBILITY.		
		Water.	Alcohol.	Other Solvents.
A thin and very diffusive, clear, and colorless liquid. It boils at 37° C. (98.6° F.). Stronger Ether is highly volatile and inflammable, and its vapor, when mixed with air and ignited, explodes violently. Sp. gr. 0.725 to 0.728.	Refreshing, characteristic odor; burning and sweetish taste, slightly bitter after-taste; neutral reaction.	Ten times its volume of water at 15° C. (59° F.).	All proportions.	All proportions of chloroform, benzol, benzin, fixed and volatile oils.

TESTS FOR IDENTITY AND QUANTITATIVE TEST.	IMPURITIES.	TESTS FOR IMPURITIES.
It should boil actively, in a test-tube half filled with it and held a short time in the hand, on the addition of small pieces of broken glass.	Acidity.	If a piece of pale blue litmus paper moistened with water be immersed ten minutes in a portion of the Ether, the color should not change.
When 10 C.c. of Stronger Ether are agitated with an equal volume of glycerin in a graduated test-tube, the Ether layer, when fully separated, should not measure less than 8.6 C.c.	Non-volatile Impurities and Foreign Odors.	On evaporating at least 50 C.c. of Stronger Ether in a glass vessel, no fixed residue should appear, and, on evaporating a portion dropped upon blotting-paper, no foreign odor should be developed.
	Undue amount of Alcohol or Water.	When 20 C.c. of Ether are shaken in a graduated tube, with 20 C.c. of water just previously saturated with ether, the ethereal layer, upon separation, should not measure less than 19.8 C.c.
	Aldehyde.	If 10 C.c. of Ether be shaken occasionally, within one hour, with 1 C.c. of potassium hydrate T.S., no color should be developed in either liquid.

Uses.—Ether is used principally as an anæsthetic, and, notwithstanding the many efforts made to supplant it, continues to be the best agent yet discovered for producing insensibility to pain in surgical operations. It is also used as a solvent. It dissolves iodine and bromine freely, and sulphur and phosphorus sparingly. Its power to dissolve corrosive sublimate makes it a useful agent in the manipulations for detecting that poison. It is also a solvent of volatile and fixed oils, many resins and balsams, tannic acid, caoutchouc, and most of the alkaloids.

Ether should be kept in well-stoppered bottles, or in soldered tins, in a cool place remote from lights and fire. Especial care should be observed in pouring ether from one vessel to another by gas-light: the vapor is heavy,—two and a half times as heavy as air,—and it will at once take fire with explosive force on contact with flame.

SPIRITUS ÆTHERIS. *U. S.* Spirit of Ether.

	Metric.	Old form.
Ether	325 C.c.	4 fl. oz.
Alcohol	675 C.c.	8½ fl. oz.
To make	1000 C.c.	12½ fl. oz.

Mix them.

Uses.—This simple mixture of ether and alcohol is used as a diffusible stimulant in doses of one to three fluidrachms (3.7 to 11.1 C.c.).

SPIRITUS ÆTHERIS COMPOSITUS. *U. S.* Compound Spirit of Ether.

[HOFFMANN'S ANODYNE.]

	Metric.	Old form.
Ether	325 C.c.	8 fl. oz.
Alcohol	650 C.c.	16 fl. oz.
Ethereal Oil	25 C.c.	5 fl. dr.
To make	1000 C.c.	24¾ fl. oz.

Mix them.

Commercial Hoffmann's anodyne is usually bought by the pharmacist and substituted for this preparation. It differs from the official liquid in containing variable proportions of light and heavy oil of wine, ether, and alcohol: it is obtained as a supplementary product by the manufacturing chemist.

During the rectification of crude ether, the distillation is continued as long as the ether comes over of the proper specific gravity; after which the receiver is changed, and an additional distillate is obtained, consisting of ether and alcohol impregnated with a little ethereal oil. It is this second distillate, variously modified by the addition of alcohol, ether, or water, so as to make it conform in taste, smell, opalescence, etc., to a standard preparation kept by the manufacturer, that is sold as Hoffmann's anodyne.

The expensiveness of the ethereal oil is alleged to be the cause of this substitution. The cheap commercial liquid may be known by adding it to water; it usually mixes without causing milkiness. The

official compound spirit of ether produces a slight opalescence when forty drops are added to a pint of water, and the peculiar odor of ethereal oil is distinctly noticed; but castor oil is sometimes added by dishonest manufacturers to circumvent this test. This fraud may be detected by mixing equal parts of the suspected liquid and water, and collecting the oil which separates on a piece of filtering-paper and exposing it to heat: a permanent greasy stain indicates a fixed oil, an ethereal oil stain disappears on heating.

Uses.—Compound spirit of ether is used as an anodyne, in doses of thirty minims to two fluidrachms (1.9 to 7.4 C.c.). It is sometimes given in combination with laudanum.

Preparations of the Compound Ethers of the Ethyl and Amyl Series.

OLEUM ÆTHEREUM. *U.S.* Ethereal Oil.

A volatile liquid consisting of equal volumes of Heavy Oil of Wine and Ether.

	Metric.	Old form
Alcohol	1000 C.c.	2 pints.
Sulphuric Acid	1000 C.c.	2 pints.
Distilled Water	25 C.c.	384 min.

Ether, a sufficient quantity.

Add the Acid slowly to the Alcohol, mix them thoroughly, and allow the mixture to stand, in a closed flask, for twenty-four hours, or until the liquid is clear; then pour the clear liquid into a tubulated retort of such capacity that the mixture shall nearly fill it. Insert a thermometer through the tubulure, so that the bulb shall be deeply immersed in the liquid, and, having connected the retort with a well-cooled condenser, and also having connected with the receiver a bent glass tube for conducting the uncondensed gases into water, distil, by means of a sand-bath, at a temperature between 150° and 160° C. (302°–320° F.), until oily drops cease to come over, or until a black froth, which forms on the surface, begins to rise in the retort. Separate the yellow, ethereal liquid from the distillate, and expose it to the air for twenty-four hours, in a shallow capsule. Then transfer it to a wet filter, and, when the watery portion has drained off, wash the oil which is left on the filter with the Distilled Water, which should be as cold as possible. When this also has drained off, transfer the oil to a graduated measure, and add to it an equal volume of Ether.

Keep the product in small, glass-stoppered vials, in a cool place.

Compound ethers, as already explained, are produced by the action of acids on alcohols (page 812). Ethereal oil is a mixture of compound ethers.

If alcohol is distilled with a large excess of sulphuric acid, there are formed towards the close of the distillation heavy oil of wine, sulphurous acid, olefiant gas, and empyreumatic products. The product of the distillation is generally in two layers, one consisting of water holding sulphurous acid in solution, and the other, of ether containing the heavy oil of wine. After separation, the latter liquid is exposed for twenty-four

hours to the air, in order to dissipate the ether by evaporation; and the oil which is left is washed with water to deprive it of all traces of sulphurous acid.

In the early stage of the distillation of a mixture of sulphuric acid and alcohol, ethyl-sulphuric acid, $C_2H_5HSO_4$, is formed. During its progress this is decomposed so as to yield ether. When, however, the alcohol is distilled with a large excess of sulphuric acid, the ethyl-sulphuric acid is decomposed so as to form a small quantity of the *heavy oil of wine.* This is a mixture of ethyl sulphate, $(C_2H_5)_2SO_4$, ethyl sulphite, $(C_2H_5)_2SO_3$ (the sulphurous acid having been formed by reduction of sulphuric acid), with polymeric forms of ethylene, C_2H_4. Ethereal oil is a transparent, nearly colorless, volatile liquid, of a peculiar, aromatic, ethereal odor, a pungent, refreshing, bitterish taste, and a neutral reaction to dry litmus paper. Sp. gr. 0.910.

Uses.—Ethereal oil is used solely as an ingredient in compound spirit of ether.

SPIRITUS ÆTHERIS NITROSI. *U.S.* **Spirit of Nitrous Ether.**

An alcoholic solution of Ethyl Nitrite [$C_2H_5NO_2 = 74.87$], yielding, when freshly prepared, and tested in a nitrometer, not less than 11 times its own volume of Nitrogen Dioxide [$NO = 29.97$].

	Metric.	Old form.
Sodium Nitrite	635 Gm.*	4 oz. av. 210 gr.
Sulphuric Acid	520 Gm.	8 oz. av. 292 gr.
Sodium Carbonate	10 Gm.	81 grains.
Potassium Carbonate, completely deprived of water by drying	30 Gm.	93 grains.
Deodorized Alcohol,		
Water, each, a sufficient quantity.		

Dissolve the Sodium Nitrite in 1000 C.c. [old form 6 fl. oz. 6 fl. dr.] of Water, and put the solution into a suitable flask, connected with a condenser kept cold by ice-cold water; then add 550 C.c. [old form 3 fl. oz. 6 fl. dr.] of Deodorized Alcohol, and mix well. Through a cork fitted into the mouth of the flask insert a funnel-tube dipping below the surface of the liquid. With the condenser connect a receiver, and keep this surrounded by a mixture of common salt and crushed ice. Then gradually introduce into the flask, through the funnel-tube, the Sulphuric Acid, previously diluted with 1000 C.c. [old form 6 fl. oz. 6 fl. dr.] of Water. Distillation will usually commence before the whole of the Acid has been added. When all the Acid has been introduced, regulate the distillation by the application or withdrawal of a gentle heat until no more nitrous ether distils over. Wash the distillate, first, with 100 C.c. [old form 5½ fl. dr.] of ice-cold Water to remove any Alcohol which may have passed over, and then remove any traces of Acid by washing the Ether with 100 C.c. [old form 5½ fl. dr.] of ice-cold Water, in which the Sodium Carbonate had previously been dissolved. Carefully separate the Ether from the aqueous

* In the copies of the U.S.P. 1890 at first issued this quantity was given as 770 Gm. Experience has proved that there is an unnecessary excess of 135 Gm.

liquid, and agitate it, in a well-stoppered vial, with the Potassium Carbonate to remove traces of water. Then filter it through a pellet of cotton, in a covered funnel, into a tared bottle containing 2000 C.c. [old form 13½ fl. oz.] of Deodorized Alcohol. Ascertain the weight of the Nitrous Ether filtered into the Alcohol by noting the increase of weight of the tared bottle and contents, and then add enough Deodorized Alcohol to make the mixture weigh 22 times the weight of the Nitrous Ether added. This preparation is often termed *Sweet Spirit of Nitre.*

The object of this process is to form ethyl nitrite, a compound ether produced by substituting the acid radical for the hydrogen of the hydroxyl in the alcohol: this is then preserved from decomposition by the addition of sufficient alcohol.

The U. S. P. 1890 process differs from that formerly official in the method of obtaining the nitrous radical, the use of nitric acid having been abandoned; the object of using sodium nitrite is to avoid the production of aldehyde, and to furnish a more easily controlled process than the one previously employed. The sulphuric acid decomposes the sodium nitrite, the nitrous radical combining with the ethyl of the alcohol to form ethyl nitrite. The dilution of the sulphuric acid and the use of a solution of sodium nitrite prevent too rapid action. Experience with the new process has demonstrated its advantages.

$$\underset{\text{Alcohol.}}{2C_2H_5OH} + \underset{\substack{\text{Sodium}\\\text{Nitrate.}}}{2NaNO_2} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{H_2SO_4} = \underset{\text{Ethyl Nitrite.}}{2C_2H_5NO_2} + \underset{\substack{\text{Sodium}\\\text{Sulphate.}}}{Na_2SO_4} + \underset{\text{Water.}}{2H_2O}$$

Pure ethyl nitrite is pale yellow, has the smell of apples, boils at 18° C. (64.4° F.), and has the sp. gr. 0.900 at 15.5° C. (60° F.). The density of its vapor is 2.627. Litmus is not affected by it. It is soluble in forty-eight parts of water, and in all proportions in alcohol or rectified spirit. It is highly inflammable, and burns with a white flame without residue. Mixed with an alcoholic solution of potassa, it becomes dark brown, showing the presence of aldehyd. When kept, it becomes acid in a short time, as shown by litmus; and nitric oxide is given off, which often causes the bursting of the bottle. Its tendency to become acid is rendered greater by the action of the air, and depends on the absorption of oxygen by the aldehyd, which is converted into acetic acid. These facts show the necessity of preserving this ether in small, strong bottles, kept full and in a cool place, and, in warm weather, of cooling a bottle thoroughly before opening it.

Spiritus Ætheris Nitrosi. *U. S.*	Odor and Taste.
A clear, mobile, volatile, and inflammable liquid, of a pale straw-color, inclining slightly to green. Sp. gr. about 0.836 * to 0.842 at 15° C. (59° F.). When freshly prepared, or even after being kept for some time with but little exposure to light and air, it is neutral to litmus paper. When long kept, or after having been freely exposed to air and light, it acquires an acid reaction, but it should not effervesce when a crystal of potassium bicarbonate is dropped into it.	Fragrant, ethereal pungent odor, free from acridity; sharp, burning taste.

* There are reasons for believing that this figure is too high, and that 0.820 is nearer the true specific gravity if U. S. P. deodorized alcohol (0.816) be used for dilution.

Tests for Identity.	Quantitative Test.
If a test-tube be half filled with the Spirit, and put into a water-bath heated to 65° C. (149° F.) until it has acquired this temperature, the Spirit should boil distinctly upon the addition of a few pieces of broken glass. If 10 C.c. of the Spirit be mixed with 5 C.c. of potassium hydrate T.S., previously diluted with 5 C.c. of water, the mixture will assume a yellow color which should not turn decidedly brown within twelve hours (limit of *aldehyde*.)	If 5 C.c. of recently prepared Spirit of Nitrous Ether be introduced into a nitrometer, and followed, first, by 10 C.c. of potassium iodide T.S., and then by 10 C.c. of normal sulphuric acid, the volume of nitrogen dioxide generated at the ordinary indoor temperature (assumed to be at or near 25° C. or 77° F.) should not be less than 55 C.c. (corresponding to about 4 per cent. of pure ethyl nitrite).

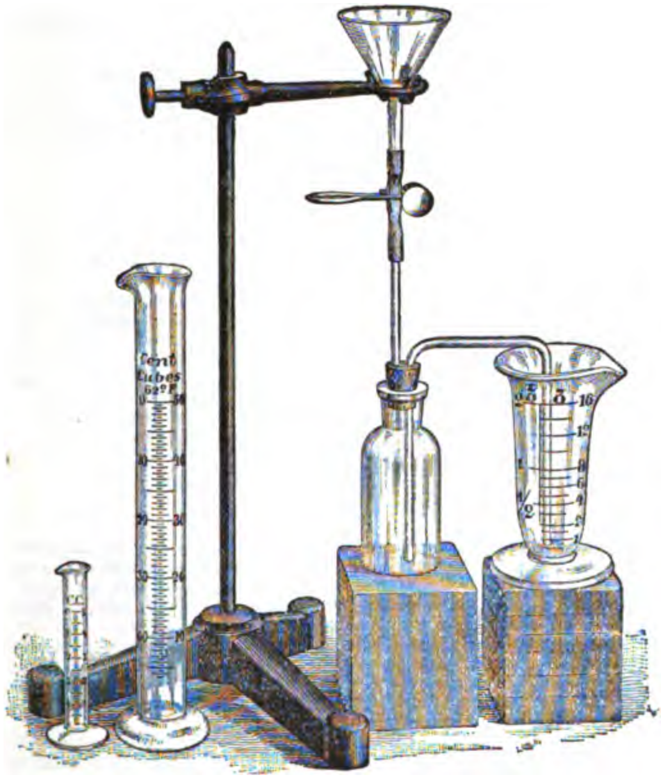
Spirit of nitrous ether is never quite free from aldehyde; and, if the distillation is too long continued, it is apt to contain a good deal of this liquid, which afterwards becomes acetic acid by absorbing oxygen. The change goes on rapidly if the preparation be insecurely kept. Aldehyde, if in considerable proportion, may be detected by imparting a pungent odor and acrid flavor, and by the preparation assuming a brown tint on the addition of a weak solution of potassa, owing to the formation of aldehyde resin. The official potassa test, with the best specimens, produces a straw-yellow tint within twelve hours.

Specific gravity cannot be relied upon as a test of the quantity of ethyl nitrite present, because both it and water are heavier specifically than the diluting liquid, alcohol. The sp. gr. of deodorized alcohol being 0.816, and that of spirit of nitrous ether 0.836 to 0.842, it follows that the heavier specific gravity of the latter should be caused by the addition of ethyl nitrite (sp. gr. 0.900), but it may be increased by diluting it with water (sp. gr. 1.000), or by using alcohol of the sp. gr. 0.825, and this is a common practice.

The nitrometer test is regarded as the only reliable one to determine the quantity of ethyl nitrite in this spirit, and the very practical apparatus shown in Fig. 352 has been devised by Dr. Squibb for the use of pharmacists who do not possess a nitrometer. This consists of a small glass funnel, a section of rubber tubing, spring pinch-cock, straight glass tube, one tube bent twice at right angles, not over $\frac{1}{12}$ inch bore, a cork with two holes for the tubes, a two-ounce vial, and some wooden blocks. In using this for testing, the bottle is filled with mercury nearly to the edge, then 10 or 20 drops of water are added. The cork holding the tubes is then pushed into the bottle, which causes the water to flow into the tube, followed by a little mercury; the funnel is connected with the upright tube and the pinch-cock closed, then about 20 minims of mercury are poured into the funnel and cautiously allowed to flow into the vial by slowly opening the pinch-cock until the bent tube is entirely filled with mercury. There must, of course, be no leakage in the apparatus. 1 fl. dr. of spirit of nitrous ether is measured into the funnel and let into the vial, followed by 1 fl. dr. of solution of potassium iodide T.S. (see official test, above), and then 1 fl. dr. of the diluted sulphuric acid. This makes 3 fl. dr. of liquid to be deducted from the measure of mercury. The reaction soon sets in, and the amount of gas set free indicates the quantity of ethyl nitrite by dis-

placing the mercury. In ten minutes the reaction is over, and the receiving measure may be taken away and the quantity of mercury read off; the mercury remaining in the tube runs back into the bottle

FIG. 852.



Nitrometer for druggists' use (Squibb).

as it should. The measure of the spirit taken for assay, divided into the measure of mercury displaced by the gas, shows the number of times that the gas exceeds the spirit. If the mercury be 11 to 13 times the volume of the spirit, the latter will have contained about 5 p. c. ethyl nitrite. Each per cent. of indicated ethyl nitrite is about equal to 1.86 per cent. of the total complex ethereal liquid in the spirit.

Uses.—Spirit of nitrous ether is a valuable diaphoretic and diuretic. The dose is thirty minims to one fluidrachm (1.9 to 3.7 C.c.).

ÆTHER ACETICUS. *U. S.* Acetic Ether.

A liquid composed of about 98.5 per cent., by weight, of Ethyl Acetate [$C_2H_5C_2H_3O_2$ = 87.8] and about 1.5 per cent. of Alcohol containing a little water. Specific gravity 0.893 to 0.895 at 15° C. (59° F.). It should be kept in well-stoppered bottles, in a cool and dark place, remote from lights or fire.

Preparation.—Acetic ether may be made in several ways. The best method is probably that of distilling a mixture of sixteen parts of

dried sodium acetate, ten parts of alcohol, and twenty parts of sulphuric acid, shaking the distillate in a bottle with exsiccated sodium acetate, and subsequently redistilling it.

$$\underset{\text{Sodium Acetate.}}{NaC_2H_3O_2} + \underset{\text{Ethyl Sulphuric Acid.}}{C_2H_5HSO_4} = \underset{\text{Ethyl Acetate.}}{C_2H_5C_2H_3O_2} + \underset{\text{Acid Sodium Sulphate.}}{NaHSO_4}.$$

Ethyl sulphuric acid is formed through the action of the sulphuric acid and heat upon the alcohol. This is then decomposed by contact with sodium acetate, ethyl acetate and acid sodium sulphate being produced.

Æther Aceticus. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A transparent and colorless liquid. It boils at about 76° C. (168.8° F.). It is inflammable, burning with a bluish-yellow flame and acetous odor, and is readily volatilized, even at a low temperature.	Strong, fragrant, ethereal, refreshing, and somewhat acetous odor, and burning, acetous taste; neutral reaction.	At 15° C. (59° F.), 8 parts.	All proportions.	In all proportions of ether, fixed and volatile oils.

Impurities.	Tests for Impurities.
Free Acid, fixed residue.	Acetic Ether should not change the color of blue litmus paper previously moistened with water, nor leave any fixed residue upon evaporation.
Alcohol or Water.	When 25 C.c. of Acetic Ether are agitated with an equal volume of water, in a graduated test-tube, the upper, ethereal layer, after its separation, should not measure less than 24.5 C.c.
Butylic and Amylic Derivatives.	If a portion be allowed to evaporate spontaneously from clean, odorless blotting-paper, the final odor should not resemble that of pine-apples.
Readily Carbonizable, Organic Impurities.	When a small portion of Ether is carefully poured upon some concentrated sulphuric acid, no dark ring should be developed at the point of contact of the two layers.

Uses.—Acetic ether is sometimes employed as an anæsthetic. Its odor is frequently noticed in old tinctures and extemporaneous mixtures which have once contained alcohol and acetic acid.

AMYL NITRIS. *U. S.* Amyl Nitrite.

A liquid containing about 80 per cent. of Amyl (principally Isoamyl) Nitrite [$C_5H_{11}NO_2 = 116.78$], together with variable quantities of undetermined compounds. It should be kept in small, dark-amber-colored and glass-stoppered vials, in a cool and dark place, remote from lights or fire.

Preparation.—This compound ether may be made by acting on amylic alcohol with nitric acid. The latter is deoxidized into nitrous acid, which acts on amylic alcohol, as shown in the reaction:

$$\underset{\text{Amylic Alcohol.}}{C_5H_{11}HO} + \underset{\text{Nitrous Acid.}}{HNO_2} = \underset{\text{Amyl Nitrite.}}{C_5H_{11}NO_2} + \underset{\text{Water.}}{H_2O}.$$

Amyl Nitris. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvent.
A clear, pale yellowish liquid. In alcoholic solution it gradually decomposes, with formation of ethyl nitrite and amylic alcohol. It boils at about 96°–99° C. (204.8°–210.2° F.), giving an orange-colored vapor. It burns with a fawn-colored flame. Sp. gr. 0.870–0.880 at 15° C. (59° F.).	Ethereal, fruity odor; pungent, aromatic taste; neutral or slightly acid reaction.	Almost insoluble.	In all proportions.	In all proportions of ether.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
If 0.26 Gm. of Amyl Nitrite, diluted with about 5 C.c. of alcohol, be introduced into a nitrometer, followed by 10 C.c. of potassium iodide T.S., and afterwards by 10 C.c. of normal sulphuric acid V.S., the volume of nitric oxide generated, measured at the ordinary indoor temperature (assumed to be at or near 25° C., or 77° F.), should be about 40 C.c. (each C.c. indicating about 2 per cent. of pure Amyl Nitrite).	Free Acid.	If 1 C.c. of normal potassium hydrate V.S. and 10 C.c. of water be mixed with a drop of phenolphtalein T.S., then 5 C.c. of Amyl Nitrite added, and the tube inverted a few times, the red tint of the alkaline layer should still be perceptible.
	Water.	It should remain transparent, or nearly so, when exposed to the temperature of melting ice.
	Aldehyde.	On shaking together equal volumes of Amyl Nitrite and potassium hydrate T.S., the aqueous layer should not acquire a deeper tint than pale yellow.

Tanner's process, which is adapted for small operations, is as follows: 10 fl. oz. of purified amylic alcohol is introduced into a large tubulated retort containing copper wire, 1 fl. oz. of strong sulphuric acid is now added, and then 1 fl. oz. of nitric acid, previously diluted with an equal bulk of water. It is gently heated to 63° C. (145.4° F.). At this temperature the reaction commences, and goes on very quietly until a bulk about equal to double the quantity of nitric acid collects in the receiver. The chemical movement now ceases, and the temperature, which has risen to near 100° C. (212° F.), begins to fall. More dilute nitric acid is added, and the process carried out as before. These additions are repeated until the amylic alcohol is exhausted, which is known by the appearance of red fumes in the retort. The whole product is washed with caustic soda, to remove hydrocyanic and other acids, and rectified over potassium carbonate, to get rid of moisture. The portion which distils over between 95° C. (203° F.) and 100° C. (212° F.) is medicinally pure amyl nitrite.

Difficulties are experienced in rectifying amyl nitrite on account of the number of products present having similar boiling points. If strong nitric acid is used instead of diluted acid, explosions are almost sure to occur.

Uses.—Amyl nitrite is a valuable remedy. It is exceedingly volatile, and is much used in asthma, angina pectoris, and similar complaints, by inhalation. It is a stimulant, producing an excessive action of the heart, and may be administered by dropping a small quantity on a handkerchief and inhaling the vapor, or by crushing a glass *pearl of amyl nitrite* in the handkerchief and inhaling.

QUESTIONS ON CHAPTER LII.

DERIVATIVES OF SUGARS THROUGH THE ACTION OF FERMENTS.

What is fermentation, and what is the difference between fermentation and putrefaction?
What are the two theories of fermentation?
Into what two classes may ferments be divided?
What are the necessary conditions to cause cane-sugar to undergo vinous fermentation?
What is the probable action of the ferment?
Explain the reactions which take place in the conversion of cellulin or starch, first, into maltose, then into glucose, then into alcohol, and finally into acetic acid.
What is the most important derivative of sugar by the action of a ferment?
What are the sources of the various ardent spirits of commerce? Of brandy? Rum? Whiskey? Holland gin? Common gin? Arrack?
Chemically considered, why are the carbon compounds called alcohols?
What are ethers? What are compound ethers?
Explain the reaction which occurs when alcohol is decomposed by acetic acid.
Whiskey—What is the Latin official name? What is its official definition?
How is it obtained, and what are the operations termed by which it is obtained from grain?
Describe it. What is its specific gravity?
What is its alcoholic strength?
How may the following impurities be detected?—viz.: More than traces of fusel oil from grain or potato spirit; an undue amount of solids; glycerin, added sugar, or spices; traces of oak tannin from casks; an undue amount of free acid.
What are its medicinal uses?
Alcohol—Describe it and give its specific gravity.
How much ethyl alcohol does it contain?
Give its formula in symbols and molecular weight.
What are the natural sources of alcohol, and how is it made?
How much alcohol, specific gravity .835, is obtained from good whiskey?
What is its principal impurity?
How may it be deprived of odor?
What is absolute alcohol?
What is the strongest alcohol which can be obtained by simple distillation?
How may it be freed from water?
Alcohol of what specific gravity may be obtained by the use of lime?
What is its boiling-point, and to what degree of cold may it be reduced without congealing?
How may its freedom from water be ascertained?
What is the empirical formula of alcohol?
What strengths of alcohol are official?
What are its uses?
What is the composition of diluted alcohol? What is its specific gravity?
How is it made?
How may it be made from alcohol of greater than the official strength?
If 55 gallons of alcohol be mixed with 45 gallons of water, how much will the mixture measure?
What is the difference between diluted alcohol and United States proof spirit?
What is the specific gravity of the latter?
What are the uses of diluted alcohol?
Ether—What is its composition? What is its specific gravity?
What is the formula in symbols of ethyl oxide?
How is stronger ether made?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Acidity, non-volatile impurities, and foreign odors.
What are its uses?
How is spirit of ether made? What is the Latin official name?
What is the dose?

Compound spirit of ether—What is the Latin name? Give the synonyme.
How is it made?
How may the cheap commercial article be known?
Where castor oil has been used to give it opalescence, how may the fraud be detected?
What is the dose?
What is ethereal oil? What is the Latin official name?
Give description and specific gravity.
How is it made?
What is ethyl-sulphuric acid?
If alcohol is distilled with a large excess of sulphuric acid, what is formed?
What are the physical properties of ethereal oil?
What is its use?
Spirit of nitrous ether—What is the Latin official name? What is its synonyme?
Give description and specific gravity.
How much ethyl nitrite does it contain?
Give formula in symbols and molecular weight.
How is it made?
Give rationale of process. What is the object of this process?
Pure ethyl nitrite—What is the specific gravity?
Give odor, taste, chemical reaction.
Spirit of nitrous ether—How may its quality be tested?
What impurity is always present, and what change results from its presence?
If in considerable proportion, how may it be detected?
Is its specific gravity a reliable test of the amount of ethyl nitrite present? Why?
Is there any reliable test to ascertain its quality?
What is the dose?
Acetic ether—What is the Latin official name?
Give the formula in symbols and molecular weight.
What is probably the best method of making it? Give rationale of process.
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Free acid, fixed impurities; alcohol, ether.
What is the dose?
Amyl nitrite—What is the Latin official name?
Give formula in symbols and molecular weight.
Give description and specific gravity.
How may it be made? Describe rationale of process.
How may the following impurities be detected?—viz.: Free acid; water.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is Tanner's process for preparing it?
If strong nitric acid is used, what occurs?
What is the dose?

CHAPTER LIII.

ALDEHYDE, ITS DERIVATIVES AND PREPARATIONS.

THE term *aldehyde*, like the terms *alcohol* and *ether*, was formerly applied to one compound. It is now used to define a class of organic bodies. The word is derived from the first syllables of the term *al*cohol *dehyd*rogenatum, which means alcohol from which hydrogen has been abstracted.

Aldehyde has the composition C_2H_4O, and is made by depriving alcohol, C_2H_6O, of two hydrogen atoms. This abstraction of hydrogen may be effected by acting on alcohol with oxidizing agents, as in making ethyl nitrite, and in other ways. By the oxidation of aldehydes acids are formed, as in making acetic acid by the beech-wood shavings process (see page 776). The addition of 2H to aldehyde, C_2H_4O, reproduces alcohol, C_2H_6O, whilst the addition of O to aldehyde, C_2H_4O, produces acetic acid, $C_2H_4O_2$.

PARALDEHYDUM. *U. S.* Paraldehyde.

$C_6H_{12}O_3 = 131.7.$

A polymeric form of Ethylic Aldehyde [$C_2H_4O = 43.9$]. Paraldehyde should be kept in well-stoppered, dark amber-colored bottles, in a cool place.

This new official liquid is a product of the condensation of three molecules of ethyl, or ordinary aldehyde; it may be made by treating ethyl aldehyde with small quantities of either sulphurous anhydride, hydrochloric acid, carbon oxychloride, or zinc chloride; almost complete conversion occurs, and by freezing the liquid and rectifying, pure paraldehyde is produced.

Paraldehydum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A colorless, transparent liquid. When cooled to near 0° C. (32° F.), Paraldehyde solidifies to a crystalline mass, which becomes liquid again at 10.5° C. (51° F.). It boils at 123°–125° C. (253.4°–257° F.), giving off inflammable vapors.	Strong characteristic, but not unpleasant or pungent odor; burning and cooling taste; neutral or slightly acid reaction.	At 15° C. (59° F.), 8.5 parts. Boiling, 16.5 parts.	Miscible in all proportions.	Miscible in all proportions with ether and fixed and volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
When distilled with a small portion of sulphuric acid, Paraldehyde is converted into ordinary aldehyde, boiling at about 21° C. (70° F.) On warming some silver ammonium nitrate T.S. saturated with Paraldehyde in a test-tube, a silver mirror will form on standing. A mixture of 8 C.c. of Paraldehyde and 8 C.c. of alcohol with 1 drop of phenolphtalein T.S. should acquire a pink color upon the addition of 0.5 C.c. of normal potassum hydrate T.S. (limit of *free acid*).	Aldehyde derived from Fusel Oil.	On heating some Paraldehyde on a water-bath, it should completely volatilize, without leaving any disagreeable odor.
	Amylic Alcohol, etc.	One C.c. of Paraldehyde should form, with 10 C.c. of water, a clear solution free from oily drops,
	Hydrochloric Acid.	And this solution, when acidulated with nitric acid, should not be affected by silver nitrate T.S.
	Sulphuric Acid.	Or barium chloride T.S.

Uses.—Paraldehyde is a hypnotic and sedative. Owing to its unpleasant taste, it is usually prescribed in combination with alcoholic liquids, elixirs, etc. The dose is from thirty minims to one fluidrachm (1.8 to 3.7 C.c.).

CHLORAL. *U. S.* Chloral.

$C_2HCl_3O + H_2O = 164.97.$ [Chloral Hydrate.]

A crystalline solid, composed of Trichloraldehyde or Chloral with one molecule of water. It should be kept in glass-stoppered bottles in a cool and dark place.

Preparation.—This valuable compound is made by passing dry chlorine gas, in a continuous stream, through absolute alcohol for six or eight weeks. The chlorine is led into cold alcohol at first, and when no more is absorbed, the alcohol is heated at first gently and then to 60° C. (140° F.). When saturated, the mixture formed is agitated with sulphuric acid at a temperature of 60° C. (140° F.) for several hours, during which time most of the hydrochloric acid escapes. The separated chloral is then rectified over calcium carbonate. This is anhydrous chloral, a colorless liquid, of a penetrating odor, of the sp. gr. 1.502. The pure chloral so obtained is then mixed in glass flasks with the necessary amount of water, and the resulting hydrate either cast into cakes or purified by crystallization. As solvents for this purpose, certain of the side-products of the chloral manufacture, after being purified and rectified, are used,—for instance, ethylen and ethyliden chloride; or, in their absence, chloroform, petroleum benzin, or carbon disulphide may be employed. The name *chloral* is derived from the first two syllables of *chlor*ine and *al*cohol.

The reaction may be thus expresssed:

$$\underset{\text{Alcohol.}}{C_2H_4H_2O} + \underset{\text{Chlorine.}}{2Cl} = \underset{\text{Aldehyde.}}{C_2H_4O} + \underset{\text{Hydrochloric Acid.}}{2HCl};$$

then

$$\underset{\text{Aldehyde.}}{C_2H_4O} + \underset{\text{Chlorine.}}{6Cl} = \underset{\text{Chloral.}}{C_2HCl_3O} + \underset{\text{Hydrochloric Acid.}}{3HCl}.$$

Chloral is thus seen to be aldehyde in which three of the atoms of hydrogen have been replaced by three atoms of chlorine: hence it is termed, in systematic nomenclature, *trichloraldehyde.*

Chloral. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Separate, rhomboidal, colorless and transparent crystals, slowly evaporating when exposed to air. It liquefies when triturated with about an equal quantity of camphor, menthol, thymol, or carbolic acid. Its aqueous solution soon acquires an acid reaction, but its alcoholic solution remains neutral. At about 58° C. (136.4° F.) it melts, forming a liquid having a specific gravity of about 1.575, which at a higher temperature should not evolve inflammable vapors. Liquefied chloral, at a temperature between 35° and 50° C. (95° and 122° F.), solidifies to a crystalline mass. At about 78° C. (172° F.) it begins to yield vapors of water and of anhydrous chloral, and it boils at 95° C. (203° F.).	Aromatic, penetrating, and slightly acrid odor; a bitterish, caustic taste; neutral reaction when fresh, but gradually acquiring an acid reaction.	Freely soluble.	Freely soluble.	Freely soluble in ether, also soluble in chloroform, benzol, benzin, carbon disulphide, and fixed or volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
When treated with alkalies, alkaline earths, or ammonia, chloroform is obtained, with a formate in solution.	Hydrochloric Acid and Chlorides.	When a Chloral solution (1 in 20) is dissolved in diluted alcohol it should not be precipitated upon addition of a few drops of nitric acid and silver nitrate T.S.
Chloral should be dry, and should not readily attract moisture in ordinarily dry air.	Chloral Alcoholate.	If 1 Gm. of Chloral be dissolved in 2 C.c. of warm water and about 8 C.c. (or a slight excess) of solution of potassium hydrate T.S. added, the mixture filtered clear through wet filter paper, and the filtrate treated with iodine T.S. until it is yellowish, no yellow, crystalline precipitate (iodoform) should appear, even after standing half an hour.

Uses.—Chloral hydrate is a hypnotic: it is generally administered in a flavored syrup. The dose is fifteen to thirty grains (0.9 to 1.9 Gm.).

CHLOROFORMUM. *U. S.* Chloroform.

$CHCl_3 = 119.08$.

[Chloroformum Purificatum, Pharm. 1880.]

A liquid consisting of 99 to 99.4 per cent., by weight, of absolute Chloroform, and 1 to 0.6 per cent. of Alcohol. It should be kept in dark amber-colored, glass-stoppered bottles, in a cool and dark place.

Preparation.—Chloroform is made by mixing six parts of chlorinated lime with twenty-five parts of water, and, after transferring the mixture to a still, one part of alcohol is added. Heat is applied, and when the temperature of 40° C. (122° F.) is reached, chloroform containing some alcohol begins to distil over. This is washed with water to separate the alcohol, and the heavy liquid is further purified by redistillation.

Chloroform, $CHCl_3$, is termed chemically *trichloro-methane*, because it can be produced by substituting three atoms of chlorine for three hydrogen atoms of *methane*, marsh-gas, CH_4. It may also be produced

by acting on chloral hydrate with an alkali, and this process is sometimes used upon a commercial scale.

When made from alcohol and chlorinated lime, the reactions are more complicated. In the first place, aldehyd, calcium chloride, and water are formed, thus:

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{CaOCl_2} = \underset{\text{Aldehyd.}}{C_2H_4O} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2} + \underset{\text{Water.}}{H_2O}.$$

Then the aldehyde reacting with calcium hypochlorite is decomposed, chloral, calcium chloride, and calcium hydrate being produced.

$$\underset{\text{Aldehyd.}}{(C_2H_4O)_2} + \underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{6(CaOCl_2)} = \underset{\text{Chloral.}}{(C_2HCl_3O)_2} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{3CaCl_2} + \underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{3Ca(HO)_2}.$$

Then chloral is decomposed by calcium hydrate, chloroform and calcium formate being produced.

$$\underset{\text{Chloral.}}{(C_2HCl_3O)_2} + \underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{Ca(HO)_2} = \underset{\text{Chloroform.}}{(CHCl_3)_2} + \underset{\text{Calcium Formate.}}{Ca(CHO_2)_2}.$$

Chloroform is now more profitably made by reacting on acetone with chlorinated lime; the liquid products (ketones) resulting from the decomposition of crude acetates at high temperatures may also be used. The acetone must be very pure; the yield is sometimes nearly 200 per cent. The reaction is as follows:

$$\underset{\text{Acetone.}}{2C_3H_6O} + \underset{\substack{\text{Calcium}\\\text{Hypochlorite.}}}{3Ca(OCl)_2} = \underset{\text{Chloroform.}}{2CHCl_3} + \underset{\substack{\text{Calcium}\\\text{Hydrate.}}}{2Ca(OH)_2} + \underset{\substack{\text{Calcium}\\\text{Acetate.}}}{Ca(C_2H_3O_2)_2}.$$

Chloroformum. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A heavy, clear, colorless, mobile and diffusible liquid. Sp. gr. not below 1.490 at 15° C. (59° F.), or 1.473 at 25° C. (77° F.). It boils at 60° to 61° C. (140° to 141.8° F.). Chloroform is volatile even at a low temperature; it is not inflammable, but its heated vapor burns with a green flame.	Characteristic, ethereal odor; burning, sweet taste; neutral reaction.	200 parts.	All proportions.	All proportions of ether, also benzol, benzin, fixed or volatile oils.

Tests.	Impurities.	Tests for Impurities.
If 20 C.c. of Chloroform be poured upon a clean, odorless filter laid flat upon a warmed porcelain or glass plate, and the plate be rocked from side to side until the liquid is all evaporated, no foreign odor should become perceptible as the last portions disappear from the paper, and the paper should be left nearly odorless when compared with a new, odorless filter.	Acids.	If 10 C.c. of Chloroform be thoroughly agitated with 20 C.c. of distilled water, the latter, when separated, should not affect blue litmus paper.
	Chloride.	If 10 C.c. of Chloroform be thoroughly agitated with 20 C.c. of distilled water, the latter, when separated, should not be affected by silver nitrate T.S.
	Free Chlorine.	If 10 C.c. of Chloroform be thoroughly agitated with 20 C.c. of distilled water, the latter should not be affected by potassium iodide T.S.

TESTS.—*Continued.*

TESTS.	IMPURITIES.	TESTS FOR IMPURITIES.
If 40 C.c. of Chloroform be shaken with 4 C.c. of colorless, concentrated sulphuric acid in a 50 C.c. glass-stoppered cylinder during 20 minutes, and the liquids be then allowed to separate completely so that both are transparent, the Chloroform should remain colorless, and the acid should appear colorless, or very nearly so, when seen in a stratum of not less than about 15 Mm. in thickness. (*Impurities decomposable by Sulphuric Acid.*)	Absence of products of decomposition in Chloroform which may otherwise be pure.	If to about 5 C.c. of Chloroform, contained in a dry test-tube of the capacity of about 10 C.c., about 4 C.c. of perfectly clear barium hydrate T.S. be added without agitation, and the test-tube be then corked and set aside in a dark place for six hours, no film should be visible at the line of contact of the two liquids.
	Odorous Decomposition Products.	If 2 C.c. of the sulphuric acid, separated from the Chloroform, be diluted with 5 C.c. of distilled water, the liquid should become colorless and clear, and, while hot from the mixing, should be odorless, or give but a faint vinous or ethereal odor.
	Chlorinated Compounds.	When further diluted with 10 C.c. of distilled water, it should remain clear, and not be affected by silver nitrate T.S. If 10 C.c. of the Chloroform, separated from the acid, be well shaken with 20 C.c. of distilled water, and the liquid be allowed to separate completely, the watery portion should not be affected by silver nitrate T.S.

Purification.—Chloroform which fails to respond to the above tests should be purified by the following process:

Chloroform, *four hundred grammes*	400 Gm.
Sulphuric Acid, *eighty grammes*	80 Gm.
Dried Sodium Carbonate, *twenty grammes*	20 Gm.
Deodorized Alcohol, *four cubic centimeters*	4 C.c.

Add the Sulphuric Acid to the Chloroform, contained in a glass-stoppered bottle, and shake them together occasionally during twenty-four hours, avoiding exposure to bright daylight. Separate the lighter Chloroform layer, add to it the Dried Sodium Carbonate, previously rendered anhydrous by heating it, in a porcelain capsule, on a sand-bath, until it ceases to give off aqueous vapor, and shake them together frequently and thoroughly during half an hour; then transfer the Chloroform to a dry retort, add to it the Alcohol, and distil, by means of a water-bath, at a temperature not exceeding 67.2° C. (153° F.), into a well-cooled, tared receiver, until the distillate measures *two hundred and fifty-five* (255) *cubic centimeters.*

Chloroform sometimes contains a chlorinated pyrogenous oil which renders it unfit for its most important use, that of an anæsthetic, and the object of the above process is to purify it. Sulphuric acid decomposes this contaminating oil, and in turn is blackened by it. The chloroform is separated from the sulphuric acid, agitated with solution of sodium carbonate to neutralize adhering acid, then mixed with alcohol, which acts as a preservative from decomposition, and redistilled (preferably from lime) to separate water.

Uses.—Purified chloroform is used as an anæsthetic by inhalation. Taken internally, in large doses, one to two fluidrachms (3.7 to 7.4 C.c.) it is narcotic; in small doses, ten to fifteen minims (0.6 to 0.9 C.c.) it is carminative and sedative. Externally it is irritant, and may produce blisters.

Official Preparations.

Aqua Chloroformi . . . . Chloroform Water.	A saturated, aqueous solution of chloroform (see page 289).
Spiritus Chloroformi . . . . Spirit of Chloroform.	Made by mixing 60 C.c. of chloroform with 940 C.c. of alcohol. (See page 330.)
Emulsum Chloroformi . . . . Emulsion of Chloroform.	Made by mixing 40 C.c. of chloroform with 15 Gm. of powdered tragacanth in a dry bottle, and 250 C.c. of water, then adding gradually 60 C.c. of expressed oil of almond, and enough water to make 1000 C.c. (see page 302).
Linimentum Chloroformi . . . . . Chloroform Liniment.	Made by mixing 300 C.c. of chloroform with 700 C.c. of soap liniment. (See page 340.)

IODOFORMUM. *U. S.* Iodoform.

CHI_3; 392.56.

Preparation.—Iodoform may be made by Filhol's process, which consists in heating, in a water-bath, one hundred parts of alcohol, two hundred parts of acid potassium carbonate, and one thousand parts of distilled water, and gradually adding one hundred parts of iodine in small portions. Chlorine gas is passed through the mixture to cause the separation of the iodoform, which may be filtered out. The filtrate may be concentrated and decomposed by excess of nitric acid. The collected crystals of iodoform are now well washed with the smallest quantity of cold distilled water, spread out on pieces of bibulous paper, and dried in the open air.

$$\underset{\text{Alcohol.}}{C_2H_5HO} + \underset{\text{Iodine.}}{8I} + \underset{\text{Acid Potassium Carbonate.}}{2KHCO_3} = \underset{\text{Potassium Iodide.}}{2KI} + \underset{\text{Iodoform.}}{2CHI_3} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{2CO_2}.$$

Iodoformum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
Small, lemon-yellow, lustrous crystals of the hexagonal system. Sp. gr. 2.000 at 15° C. (59° F.).	Saffron-like and almost insuppressible odor; unpleasant, slightly sweetish, iodine-like taste; solutions have a neutral reaction.	Very slightly soluble in water, to which it imparts its odor and taste.	At 15° C. (59° F.), 52 parts. Boiling, 12 parts.	Soluble in 5.2 parts of ether, and in chloroform, benzin, and fixed and volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
It is slightly volatile even at ordinary temperatures, and in boiling water distils very slowly over with its vapor; at about 115° C. (239° F.) it melts to a brown liquid, and at a higher temperature yields vapors containing iodine and carbonaceous matter. If 0.1 Gm. of Iodoform be digested with 5 C.c. of a 5-per-cent. solution of potassium hydrate in alcohol, the mixture, when acidulated with diluted nitric acid, will give a blue color with starch T.S.	Soluble Yellow Coloring Matters, Picric Acid, etc.	If 2 Gm. of Iodoform be thoroughly shaken with 10 C.c. of water, the filtrate should be colorless and free from bitter taste,
	Free Acids.	Should not affect the color of litmus paper,
	Soluble Iodides.	And should remain unaffected by silver nitrate T.S.
	Foreign Impurities.	Upon full combustion, Iodoform should leave no residue.

Uses.—Iodoform is used principally as an alterative. It is also antiseptic and anæsthetic. The dose is one to three grains (0.06 to 0.19 Gm.).

Official Preparation.

Unguentum Iodoformi . 10 Gm. of Iodoform to 90 Gm. of Benzoinated Lard.
Iodoform Ointment.

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products.

Acetal, $C_6H_{14}O_2$, or $CH_3CH(OEt)_2$, Ethylidene Diethylic Ether.	Narcotic. Dose, one drachm (3.8 Gm.).
Aldehyde, C_2H_4O.	By gently warming a mixture of alcohol, manganese dioxide, sulphuric acid, and water, and collecting the vapor which is formed by means of a condenser. If exposed, it will gradually be converted into acetic acid. It is a colorless, thin, and very inflammable liquid, having an ethereal odor, and the sp. gr. .805.
Amyl Acetate, $C_5H_{11}.C_2H_3O_2$.	By distilling amyl alcohol with an acetate and sulphuric acid. It is when pure a colorless liquid having a very fragrant odor. Insoluble in water. Sp. gr. .876.
Amyl Butyrate, $C_5H_{11},C_4H_7O_2$.	Sp. gr. .852. Fragrant odor.
Amyl Chloride, C_5H_{11},Cl.	By the action of strong hydrochloric acid upon amylic alcohol. Sp. gr. .874.
Amyl Iodide, $C_5H_{11}.I$.	By acting upon amylic alcohol with iodine and phosphorus. It is a colorless, transparent liquid, of a faint odor and a pungent taste. Sp. gr. 1.509.
Amyl Valerianate, $C_5H_{11},C_5H_9O_2$.	Sp. gr. .864. Odor of apples.
Amylene (Valerene, Pentene), C_5H_{10}.	A colorless liquid, having a peculiar, disagreeable smell; density, 0.655 at 10° C. (50° F.). Anæsthetic. Too dangerous for use.
Amylene Hydrate.	Used as a hypnotic. Dose, fʒi (3.7 C.c.).
Barium Sulphethylate, $Ba(C_2H_5SO_4)_2$.	By neutralizing ethyl-sulphuric acid with barium carbonate, filtering off the insoluble barium sulphate, and evaporating the filtrate to crystallization.
Bromal, C_2HBr_3O.	Hypnotic. Dose, three grains (0.194 Gm.).
Bromamide, $C_6H_2Br_3NH.HBr$.	Antipyretic, analgesic, and antirheumatic. Dose, ten to fifteen grains (0.65 to 0.97 Gm.).
Bromoform, $CHBr_3$.	By acting simultaneously upon wood spirit with bromine and potassa. It is a limpid liquid, resembling chloroform, and has an agreeable odor and a saccharine taste. Local anæsthetic in whooping-cough. Dose, for a child two to four years old, four to five drops three or four times daily.
Bromopyrin (Monobromantipyrin), $C_{11}H_{11}BrN_2O$.	In white, crystalline needles. Soluble in alcohol and chloroform. Slightly soluble in hot water.
Butyl Chloral, $C_4H_5Cl_3O$. Butyl Chloral-Hydrate, $C_4H_5Cl_3O.H_2O$.	By passing chlorine gas into aldehyde when it is formed in addition to chloral. It is a dense, oily liquid, of peculiar odor. It dissolves when treated with an excess of warm water, and on cooling deposits *Butyl chloral-hydrate.* Used as a hypnotic in ten-grain (0.6 Gm.) doses.
Calcium Sulphethylate, $Ca(C_2H_5SO_4)_2$.	By neutralizing ethyl-sulphuric acid with calcium carbonate, filtering off the insoluble calcium sulphate, and evaporating the filtrate to crystallization.
Carbonei Tetrachloridum, Carbon Tetrachloride, Tetrachlor-Methane, Chlorocarbon, Carboneum Chloratum, CCl_4.	Anæsthetic. A colorless liquid. Sp. gr. 1.599.
Chloralamide, Chloral Formamide, $CCl_3CH\begin{cases}OH\\CONH_2\end{cases}$.	Hypnotic. Dose, thirty to sixty grains (1.9 to 3.88 Gm.).
Chloral-Ammonium, $CCl_3CH(NH_2)OH$.	Used as a hypnotic and substitute for chloral and urethane. Dose, fifteen to thirty grains (0.9 to 1.9 Gm.). Called also tri-chlor-amido-ethylic alcohol.
Chloral Carbamide.	Similar to chloral in its action, but slow and uncertain.
Chloral Carbol, Carbolated Chloral.	Used locally as an anæsthetic and counter-irritant.
Chloral Cyanhydrate, $CCl_3—CH—\begin{cases}OH\\CN\end{cases}$.	A substitute for hydrocyanic acid. 6½ parts, by weight, correspond with 1 part of anhydrous hydrocyanic acid.
Chloralimide, $CCl_3CH=NH$.	Antipyretic and analgesic. Dose, three to seven grains (0.19 to 0.45 Gm.).

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products.— *Continued.*

Chloral-Menthol, Mentholated Chloral.	An oily, colorless liquid, with a mint-like odor. Sp. gr. 1.984. Counter-irritant and local anæsthetic.
Chloralose, $C_8H_{11}Cl_3O_6$.	Hypnotic. Dose, twelve grains (0.775 Gm.).
Chloral-Urethane (Uralium), $CCl_3CH\begin{cases}OH\\NHCO_2C_2H_5\end{cases}$.	Hypnotic. Dose, 15.5 grains (1 Gm.).
Copper Sulphethylate, $Cu(C_2H_5SO_4)_2$.	By mixing alcoholic solutions of ethyl sulphydrate and copper acetate and collecting the gelatinous precipitate.
Croton Chloral-Hydrate.	The same as butyl chloral-hydrate (see above).
Ethyl Benzoate, $C_2H_5.C_7H_5O$.	By heating to 100° C. in a sealed glass tube a mixture of alcohol and benzoic acid. It is a colorless, oily liquid, with a pleasant aromatic smell and a pungent taste. Sp. gr. 1.051.
Ethyl Bromide, C_2H_5Br.	By mixing amorphous phosphorus with absolute alcohol, and adding bromine gradually, then distilling carefully, and washing with a small quantity of solution of soda to remove any free bromine. A transparent and colorless liquid. Sp. gr. 1.40. Very volatile. It has a strong ethereal odor and a pungent taste.
Ethyl Butyrate, $C_2H_5,C_4H_7O_2$.	By heating together a mixture of strong sulphuric acid, butyric acid, and strong alcohol. A transparent, colorless, very thin liquid. It has an odor resembling that of pineapple. Sp. gr. .902.
Ethyl Chloride, C_2H_5,Cl.	By saturating absolute alcohol with hydrochloric acid gas, distilling in a water-bath, collecting the distillate in a bottle containing water, then immersing in water surrounded by ice, and, lastly, washing with water to remove free alcohol, then rectifying over magnesia. A thin, colorless liquid, having an ethereal odor, and a sweet, afterwards alliaceous, taste. Very inflammable. Sp. gr. .920.
Ethyl Cyanide, Hydrocyanic Ether, Propionitrile, C_3H_5N, or $C_2H_5.CN$.	A colorless liquid. Sp. gr. 0.78. Very poisonous, but less so than hydrocyanic acid, with which it agrees in therapeutic action and dose.
Ethyl Disulphide, C_2H_5S.	By acting upon potassium disulphide in concentrated solution with potassium sulphethylate. A colorless, oily liquid, having a very strong odor and a sharp, sweetish taste.
Ethyl Iodide, C_2H_5I.	By acting upon alcohol with iodine and phosphorus. A colorless, volatile liquid, but gradually turning brown in the light. Slightly soluble in water. Sp. gr. 1.946. Anæsthetic, antispasmodic, and stimulant. Dose, fifteen drops three or four times a day, inhaled from a handkerchief.
Ethyl Pelargonate (Grape Oil), $C_2H_5,C_9H_{17}O_2$.	By adding sulphuric acid and water to wine lees, and distilling in a current of steam. A colorless, mobile liquid, of a strong vinous odor. Almost insoluble in water, but soluble in alcohol. Sp. gr. .860.
Ethyl Sulphydrate (Mercaptan), C_2H_5,HS.	By distilling crystallized calcium sulphethylate with a solution of barium sulphydrate, collecting the product in a well-cooled receiver, then decanting the aqueous portion, and purifying the mercaptan by distilling with mercury, and dehydrating by calcium chloride. A colorless, very mobile liquid, having an alliaceous odor.
Ethylene Bromide, $C_2H_4Br_2$.	Contains 90.9 per cent. of bromine. Dose, six drops three times a day.
Ethylidene Chloride, Chlorinated Muriatic Ether, Ethydene-Chloride, CH_3CHCl_2.	A colorless liquid, somewhat resembling chloroform. Sp. gr. 1.175 at 17° C.; boiling at 60° C. Anæsthetic.
Ethyl-Sulphuric Acid (Sulphovinic Acid), $C_2H_5.HSO_4$.	By reacting upon sulphuric acid with alcohol. It is found in the preparation of ether.
Ethyl Valerate, $C_2H_5.C_5H_9O_2$.	A colorless liquid, having a fruity odor, also like that of valerian. Sp. gr. .866. It is also called ethyl valerianate.
Euphorin, Phenyl Urethane, $CO{<}{\begin{smallmatrix}OC_2H_5\\NH(C_6H_5)\end{smallmatrix}}$.	Antipyretic, antiseptic, antirheumatic, and analgesic. Dose, seven and a half grains (0.49 Gm.), equivalent to fifteen grains (0.972 Gm.) of antipyrin.

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products.— *Continued.*

Exalgine, Methylacetanilid, $C_6H_5N(CH_3)COCH_3$, or $C_9H_{11}NO$.	Antipyretic, analgesic, and antispasmodic. Dose, three to six grains (0.194 to 0.389 Gm.), not more than twelve grains being given in twenty-four hours.
Formol, Formaldehyde, $HCOH + H_2O$.	Antiseptic. Used for the preservation of beer, wine, etc.
Iodal.	Made by the action of iodine on alcohol and nitric acid. It resembles chloral in its therapeutic action.
Iodol, Tetraiodopyrrol, C_4I_4NH.	Nearly insoluble in water, but soluble in alcohol, ether, chloroform, and fatty oils. Contains nearly 90 per cent. of iodine. Used as a substitute for iodoform. Dose, one to three grains.
Menthiodol.	Prepared by carefully heating 4 parts of menthol in a capsule, adding 1 part of finely powdered iodol, and triturating into a homogeneous mass. Used as a local application in neuralgia.
Methacetin, Para-acetanisidine, Paraoxymethylacetanilid, $C_6H_4(OCH_3).NHC_2H_3O$.	Antipyretic, analgesic, antirheumatic. Dose, seven and a half grains (0.49 Gm.).
Methyl Acetate, $CH_3,C_2H_3O_2$.	(Prepared by processes similar to those employed for obtaining ethyl acetate, *quod vide.*) It is present to some extent in crude wood naphtha. Sp. gr. .919. Readily soluble in water.
Methyl Chloride, CH_3Cl.	By distilling together a mixture of methyl alcohol, sodium chloride, and sulphuric acid. It is a gas at ordinary temperatures, but may be condensed by pressure to a colorless, very mobile liquid. It has an ethereal smell and a sweet taste. Used chiefly as a refrigerating agent.
Methyl Iodide, CH_3I.	By distilling 1 part phosphorus, 8 parts iodine, and 12 parts wood spirit, allowing the distillate to pass into a bottle containing water, then rectifying the product in a water-bath over calcium chloride and lead oxide. A colorless liquid. Sp. gr. 2.23. Vesicant. It is best applied on lint.
Methylal, $CH_2 < {OCH_3 \atop OCH_3}$.	A colorless liquid, easily soluble in water, in alcohol, in fatty and in ethereal oils. Used as a hypnotic. Dose, seventy-five to one hundred grains (4.9 to 6.4 Gm.).
Methylene Dichloride, Dichloro-methane, Bichloride of Methylene, CH_2Cl_2.	A colorless liquid (sp. gr. 1.344), having an odor analogous to that of chloroform. Anæsthetic. Given internally in the dose of ten to thirty minims (0.62 to 1.85 Gm.).
Methylethylcarbinol, CH_3 / $\lvert$ / $CH.OH$ / $\lvert$ / C_2H_5.	Antipyretic. Isomeric with trimethylcarbinol.
Methylic Alcohol, Wood Naphtha.	Narcotic, sedative, and anti-emetic.
Methylic Ether, Oxide of Methyl, $(CH_3)_2O$.	Anæsthetic.
Pental (Trimethylethylene β-iso-amylene), $(CH_3)_2C = CH.CH_3$, or C_5H_{10}.	A colorless, inflammable liquid. Sp. gr. 0.678. Anæsthetic. Cardiac depressant.
Pentane (Amylhydride), $CH_3.CH_2.CH_2.CH_2.CH_3$.	A colorless, volatile liquid (sp. gr. 0.626), very inflammable. Proposed as an anæsthetic.
Phenocoll Hydrochloride, $C_6H_4 \begin{cases} OC_2H_5 \\ NH.COCH_2NH_2HCl_2 \end{cases}$.	Antipyretic, antirheumatic. Dose, eight to twelve grains (0.518 to 0.775 Gm.).
Phenylurethan, Phenylcarbamate of Ethyl, Euphorine, $C_9O_2H_{11}N\left(CO \begin{cases} OC_2H_5 \\ NH(C_6H_5) \end{cases}\right)$.	Antipyretic, analgesic, and antirheumatic. Dose, seven to fifteen grains (0.454 to 0.972 Gm.). Used also as an antiseptic dressing.
Piperazine, Diethylendiamine, $N_2 \begin{cases} H_2 \\ (C_2H_4)_2 \end{cases}$.	Antirheumatic and solvent of uric acid. Dose, fifteen grains (0.972 Gm.) during the day.

Unofficial Ethyl, Amyl, and Methyl Compounds, and Allied Products.— *Continued.*

Potassium Ethylate, C_2H_5KO.	By treating absolute alcohol with potassium. It crystallizes in colorless crystals.
Potassium Sulphethylate, $KC_2H_5SO_4$.	By acting upon mercaptan with potassium. It is a dull white, granular mass, very soluble in water.
Silver Sulphethylate, $AgC_2H_5SO_4$.	By adding silver nitrate to an aqueous solution of mercaptan and collecting the white precipitate.
Sodium Ethylate, C_2H_5NaO.	By treating absolute alcohol with sodium. It crystallizes in broad laminæ.
Somnal.	Said to be a solution of chloral hydrate and urethane in alcohol. Dose, from one-half to one drachm (1.94 to 3.88 Gm.).
Sozal, $(C_6H_4(OH)SO_3)_6Al_2$, Aluminum Paraphenolsulphonate.	Antiseptic.
Soziodol, Diiodparaphenolsulphonic Acid, $C_6H_2I_2(SO_3H)OH$.	Bactericide.
Sulphaminol, $C_{10}H_4(OH)NS$, Thioxydiphenylamine.	Used as a substitute for iodoform. The dose is four or five grains. Externally it may be used in powder or in oily mixtures.
Sulphonal, $(CH_3)_2C(C_2H_5SO_2)_2$.	Not very soluble in water; soluble in alcohol and ether. Hypnotic dose, fifteen to thirty grains (0.9 to 1.9 Gm.). It is also called Diethylsulphondimethylmethane.
Thymacetin, $C_6H_2CH_3C_3H_7\left\{\begin{array}{l}OC_2H_5\\NH(C_2H_3O).\end{array}\right.$	Antiseptic, analgesic, and hypnotic. Dose, three to fifteen grains (0.19 to 0.9 Gm.).
Tri-methyl-amine, Propylamine.	The chloride is usually preferred for internal use. Dose, seven to twenty grains (0.4 to 1.3 Gm.).
Trional, $C\left\{\begin{array}{l}SO_2C_2H_5\\SO_2C_2H_5\\CH_3\\C_2H_5\end{array}\right.$ Tetronal, $C\left\{\begin{array}{l}SO_2C_2H_5\\SO_2C_2H_5\\C_2H_5\\C_2H_5.\end{array}\right.$	Sedative hypnotics. Dose, fifteen to thirty grains (0.9 to 1.9 Gm.).
Urethane (Ethyl Carbonate), $CO.(NH_2)OC_2H_5$.	Used as a hypnotic, in doses of forty to sixty grains (2.6 to 3.8 Gm.).

QUESTIONS ON CHAPTER LIII.

ALDEHYDE, ITS DERIVATIVES AND PREPARATIONS.

What is meant by the term aldehyde? What is the derivation of the word? What is its chemical composition?

What is produced when 2H is added to aldehyde? What is the dose?

Paraldehyde—Give Latin name, formula in symbols, and molecular weight.

How is it made? What are its uses and dose?

Chloral—Give Latin name, formula in symbols, molecular weight, and synonyme. From what is the name derived?

How is it made? Describe the rationale of the process.

What is the difference in composition between chloral and aldehyde?

Hence, what is its name in systematic nomenclature?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Acids; hydrochloric acid; organic impurities; inorganic impurities; alcoholate of chloral. What is the dose?

Chloroform—What is the Latin name?

Give formula in symbols, and molecular weight. How is it made?

What is the object of this process, and how does it act?

What is it termed chemically, and why?

What is the reaction when it is produced by acting on chloral hydrate with an alkali?

What are the reactions occurring when it is made from alcohol and chlorinated lime?

What are the tests of the U. S. Pharmacopœia?

Describe odor, taste, chemical reaction, and solubility.

How may the following impurities be detected?—viz.: Acids; chloride; free chlorine; aldehyde; organic impurities; volatile impurities. What is the dose?

What are its official preparations?

Iodoform—What is the Latin name?

Give formula in symbols and molecular weight.

What is Filhol's process for making it? What is the rationale of the process?

Describe odor, taste, chemical reaction, and solubility. What are tests for its identity? What is the dose?

How may the following impurities be detected?—viz.: Iodine; foreign impurities.

CHAPTER LIV.

PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS.

THE acid saccharine fruits form an important class in medicine and pharmacy. Their principal constituent is usually a vegetable acid (in some fruits several acids are found); sugar and albuminous principles are present in small amount, and on account of their presence vinous fermentation may be induced in their juices, resulting in the production of important alcoholic liquids. The fruits of this class which contribute the most useful products to pharmacy are grapes, lemons, limes, oranges, apples, tamarinds, raspberries, mulberries, pineapples, strawberries, currants, blackberries, etc. Most of the juices of these fruits readily undergo fermentation: the clear alcoholic liquid left after decomposition has received various names according to the fruit from which it is derived,—viz., wine from grapes, cider from apples, perry from pears, etc. The products from the grape will be considered first.

VINUM ALBUM. *U. S.* White Wine.

An alcoholic liquid, made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* (nat. ord. *Vitaceæ*), freed from seeds, stems, and skins.

VINUM RUBRUM. *U. S.* Red Wine.

An alcoholic liquid, made by fermenting the juice of fresh colored grapes, the fruit of *Vitis vinifera* (nat. ord. *Vitaceæ*), in presence of their skins.

The grape is the fruit of *Vitis vinifera;* the juice contains grape-sugar, tannin, acid potassium tartrate, calcium tartrate, potassium sulphate, sodium chloride, pectin, albuminous principles, and water. It will be seen that grape-juice naturally contains all the substances essential to the production of vinous fermentation, a favorable temperature and the presence of the atmosphere being alone needed to convert it into wine.

Preparation.—The grape-juice is run into vats, and constitutes the *must.* The temperature of the air being about 15.6° C. (60° F.), fermentation gradually takes place in the must, which becomes sensibly warmer and emits a large quantity of carbonic acid. The liquor from being sweet becomes vinous, owing to the conversion of the grape-sugar into alcohol. When the liquor has acquired a strong vinous taste and become perfectly clear, the wine is considered formed, and is racked off into casks. But even after this stage of the process the fermentation continues for several months. During the whole of this period a frothy matter is formed, which for the first few days collects round the bung, but afterwards precipitates along with coloring-matter and tartar, forming a deposit which constitutes the wine-lees. Wines are sweet,

dry, light, sparkling, still, acid, or rough, according to the character of the grape-juice and the method employed in making the wine. When the quantity of sugar in the juice is large, and the amount of ferment insufficient to convert all the sugar into alcohol, a *sweet* wine is produced; if, on the other hand, the quantity of ferment is sufficient to convert all the sugar into alcohol, a *strong* or *generous* wine is formed. If only a moderate amount of sugar is present in the juice, with enough ferment to convert all of it into alcohol, the wine is termed *dry*. A small proportion of sugar results in the production of a *light* wine; if a large quantity of ferment is present, however, a *sour* wine is produced, because the fermentation has progressed until acetic acid is formed. Wines are *sparkling* or *still* according as they contain carbonic acid or not, and, if fermented in contact with the seeds which contain tannin, they are *rough* or astringent. Two kinds of wine are official,—Vinum album, white wine, and Vinum rubrum, red wine: any of the commercial brands of wine which fulfil the requirements of the Pharmacopœia may therefore be used. The official recommendation is as follows: "When White Wine is prescribed without further specification, it is recommended that a dry White Wine of domestic production (such as California Riesling, Ohio Catawba, etc.) be employed. When Red Wine is prescribed without further specification, it is recommended that a dry Red Wine of domestic production (such as a native Claret, Burgundy, etc.) be employed."

Vinum Album. *U.S.*	Odor, Taste, and Reaction.
A pale amber-colored or straw-colored liquid. White Wine should have a sp. gr. of not less than 0.990, nor more than 1.010, at 15.6° C. (60° F.).	A pleasant odor free from yeastiness; a fruity, agreeable, and slightly spirituous taste, without excessive acidity or sweetness.

Alcoholmetrical Test.	Impurities.	Test and Limits for Impurities.
Tested by the following method, White Wine should be found to contain not less than 10 nor more than 14 per cent., by weight (equivalent to 12.4 to 17.3 per cent. by volume), of absolute alcohol: Take the specific gravity (to four decimals) of a sufficient portion of the White Wine carefully measured at the temperature of 15.6° C. (60° F.) (noting its weight also), evaporate the Wine in a tared capsule to one-third of its original weight, cool, and add water until the liquid measures its original volume at 15.6° C. (60° F.); then take the specific gravity (to four decimals) again. The difference between the two specific gravities deducted from 1.0000 corresponds to the specific gravity of an alcohol containing the same percentage of absolute alcohol, by weight or volume, as the Wine under examination, the corresponding percentage being ascertained by referring to the alcoholmetrical table.	Tannic Acid.	If 10 C.c. of White Wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., only a faint greenish-brown color should make its appearance.
	Limit of Fixed Residue.	If a portion of White Wine be evaporated, the residue, when dried during twelve hours on a water-bath, should not amount to less than 1.5 nor more than 3 per cent.
	Limit of Free Acid.	To neutralize 50 C.c. of White Wine should require not less than 3 nor more than 5.2 C.c. of normal potassium hydrate V.S., phenolphtalein being used as indicator.

The explanation of the official quantitative test for the amount of alcohol in wine is based upon the assumption that when the alcohol

from a measured weight of wine at a given temperature is entirely evaporated without boiling or wasting it, and when the original volume has been exactly restored by the addition of pure water at the same temperature, the difference between the two specific gravities deducted from 1.0000 expresses the specific gravity of an alcoholic liquid of the same strength as that in the wine. By referring to the alcohol table the percentage of alcohol by weight corresponding to this specific gravity is ascertained, and thus the percentage of alcohol in the wine is obtained.

An example will illustrate this. If 6 fl. oz. of the wine, sp. gr. 0.9973, to be tested weigh 2727 grains, when it has been evaporated to 2 fl. oz. and the alcohol has all been driven off, and distilled water added to the residuary liquid until its original volume of 6 fl. oz. is restored, it weighs 2789 grains, and its sp. gr. is 1.0200. Then $1.0200 - 0.9973 = 0.0227$, and $1.0000 - 0.0227 = 0.9773$. Consulting the alcoholmetrical table, a mixture of alcohol and water of the sp. gr. 0.9773 is found to contain 15 per cent. of alcohol, which is the percentage by weight that the wine contains.

Vinum Rubrum. *U. S.*	Odor and Taste.
A deep red liquid. Red Wine should have a sp. gr. of not less than 0.989, nor more than 1.010, at 15.6° C. (60° F). If a portion of Red Wine be evaporated, the residue, when dried during twelve hours on a water-bath, should not amount to less than 1.6 per cent., nor more than 3.5 per cent.	A pleasant odor free from yeastiness; a fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive acidity or sweetness.

Quantitative Test.	Impurities.	Tests for Impurities.
With lead acetate T.S., Red Wine forms a heavy precipitate which may vary in color from bluish-green to green. Tested by the following method, Red Wine should be found to contain not less than 10 nor more than 14 per cent., by weight (equivalent to 12.4 to 17.3 per cent. by volume), of absolute alcohol: Take the specific gravity (to four decimals) of a sufficient portion of the Red Wine accurately measured at the temperature of 15.6° C. (60° F.), (noting its weight also), evaporate the Wine in a tared capsule to one-third of its original weight, cool, and add water until the liquid measures the original volume at 15.6° C. (60° F.); then take the specific gravity (to four decimals) again. The difference between the two specific gravities deducted from 1.0000 corresponds to the specific gravity of an alcohol containing the same percentage of absolute alcohol, by weight or volume, as the Wine under examination, the corresponding percentage being ascertained by referring to the alcoholmetrical table.	Limit of Acidity.	To neutralise 50 C.c. of Red Wine should require not less than 3 nor more than 5.2 C.c. of normal potassium hydrate V.S., eosin or fluorescein being used as indicator.
	Absence of Various Aniline Colors.	If 2 C.c. of Red Wine be mixed, in a test-tube, with two drops of chloroform and 4 C.c. of normal potassium hydrate V.S., and the mixture carefully heated, the disagreeable odor of isonitril should not become perceptible.
	Absence of Fuchsine.	If 50 C.c. of Red Wine be treated with a slight excess of ammonia water, the liquid should acquire a green or brownish-green color; if it be then well shaken with 25 C.c. of ether, the greater portion of the ethereal layer removed, and evaporated in a porcelain capsule with an excess of acetic acid and a few fibres of uncolored silk, the latter should not acquire a crimson or violet color.
	Absence of Sulpho-Fuchsine.	If 25 C.c. of Red Wine, heated to about 45° C. (113° F.), be well agitated with 25 Gm. of manganese dioxide, the liquid filtered off and acidulated with hydrochloric acid, it should not acquire a red color.
	Due to Tannic Acid.	If 10 C.c. of Red Wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., the liquid should acquire a brownish-green color.

The aroma of wines, termed their "bouquet," depends upon the formation of certain compound ethers during the fermentation, and also during the ageing or ripening process. These are said to be *œnanthic, caprylic, butyric, caproic, acetic,* and *pelargonic ethers.*

Argols.—During the fermentation of wines, especially those that are acid, a peculiar matter is deposited upon the sides and bottom of the casks, forming a crystalline crust, called *crude tartar*, or *argols*. That deposited from red wines is of a reddish color, and is called *red argols;* that derived from white wines is of a dirty-white color, and is denominated *white argols*. Both kinds consist of potassium acid tartrate rendered impure by calcium tartrate, more or less coloring-matter, and other matters which are deposited during the clarification of the wine. The deposition of the tartar is thus explained: the acid tartrate exists naturally in the juice of the grape, held in solution by the sweet aqueous liquid; when the juice is submitted to fermentation in the process for converting it into wine, the sugar disappears, and is replaced by alcohol, in which the salt is insoluble. It is from this substance that potassium acid tartrate is obtained by a process of purification (see Potassii Bitartras, page 532), and from the latter tartaric acid is produced.

Uses.—Wine is used, pharmaceutically, as a menstruum (see Vinum Album, page 381), the present requirements being that it shall contain at least 20 per cent., but not more than 25 per cent., by weight, of absolute alcohol. This insures greater stability in the medicated wines. Medicinally, wine is used as a stimulant.

SPIRITUS VINI GALLICI. *U.S.* Brandy.

An alcoholic liquid obtained by the distillation of fermented grapes, and at least four years old.

Brandy varies in quality according to the source from which it is obtained. The best brandy is obtained from French wines, and the kind called Cognac is most esteemed. Very large quantities of brandy are now made in California, but the taste is peculiar and easily distinguished from that of Cognac. The Pharmacopœia recognizes all spirits when obtained from the juice of grapes, if sufficiently strong and pure to meet the tests given below.

Spiritus Vini Gallici. *U.S.*	Impurities.	Tests for Impurities.
Brandy has a pale amber color, a distinctive taste and odor, a slightly acid reaction, and a sp. gr. not above 0.941 nor below 0.925, corresponding approximately with an alcoholic strength of 39 to 47 per cent. by weight, or 46 to 55 per cent. by volume.	Fusel Oil from grain or potato spirit.	If 100 C.c. of Brandy be very slowly evaporated in a tared capsule, on a water-bath, the last portions volatilized should have an agreeable odor, free from harshness.
	Added Sugar, Glycerin, or Aromatic Substances.	The residue, dried at 100° C. (212° F.), should weigh not more than 1.5 Gm. This residue should have no sweet or distinctly spicy taste.
	Traces of Oak Tannin from casks.	The residue should nearly all dissolve in 10 C.c. of cold water, forming a solution which is colored light green by a dilute ferric chloride T.S., made by mixing the latter with 10 volumes of water.
	Limit of Free Acid.	100 C.c. of Brandy should be rendered distinctly alkaline to litmus by 1 C.c. of potassium hydrate V.S.

Brandy owes its aroma to œnanthic and acetic ethers and other volatile products. (See Vinum Album.) Œnanthic ether is known chemically as ethyl pelargonate, $C_{11}H_{22}O_2$, but in commerce it is called *oil of cognac.* It is a fragrant, ethereal oil, of a greenish color, and is largely used in making factitious brandy.

Uses.—Brandy is not used in any official preparation. It is employed as a stimulant, and often administered with milk, yolk of eggs, etc.

ACIDUM TARTARICUM. Tartaric Acid.

$H_2C_4H_4O_6 = 149.64.$

An organic acid usually prepared from argols.

Preparation.—This important acid may be prepared by saturating the excess of acid in acid potassium tartrate or cream of tartar with calcium carbonate, and decomposing the resulting insoluble calcium tartrate by sulphuric acid, which precipitates in combination with the lime as calcium sulphate, and liberates the tartaric acid. The process, when thus conducted, furnishes only one-half of the tartaric acid. The other half may be procured by decomposing the neutral potassium tartrate remaining in the solution after the precipitation of the calcium tartrate by calcium chloride in excess. By double decomposition, potassium chloride will be formed in solution, and a second portion of calcium tartrate will precipitate, which may be decomposed by sulphuric acid together with the first portion.

$$\underset{\substack{\text{Acid Potassium}\\\text{Tartrate.}}}{2KHC_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Carbonate.}}}{CaCO_3} = \underset{\substack{\text{Potassium}\\\text{Tartrate.}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Tartrate.}}}{CaC_4H_4O_6} + \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{Dioxide.}}}{CO_2};$$

then

$$\underset{\substack{\text{Potassium}\\\text{Tartrate.}}}{K_2C_4H_4O_6} + \underset{\substack{\text{Calcium}\\\text{Chloride.}}}{CaCl_2} = \underset{\substack{\text{Calcium}\\\text{Tartrate.}}}{CaC_4H_4O_6} + \underset{\substack{\text{Potassium}\\\text{Chloride.}}}{2KCl},$$

and

$$\underset{\substack{\text{Calcium}\\\text{Tartrate.}}}{2CaC_4H_4O_6} + \underset{\substack{\text{Sulphuric}\\\text{Acid.}}}{2H_2SO_4} = \underset{\substack{\text{Calcium}\\\text{Sulphate.}}}{2CaSO_4} + \underset{\text{Tartaric Acid.}}{2H_2C_4H_4O_6};$$

Calcium sulphate is sometimes substituted for calcium chloride in the second stage of the decomposition. Tartaric acid is a dibasic acid, one or two of its hydrogen atoms are capable of being replaced by metals; with monad metals, acid, neutral, and double tartrates may be formed, thus:

$$\underset{\text{Tartaric Acid.}}{\begin{matrix}C_4H_4O_6\\H_2\end{matrix}} \qquad \underset{\substack{\text{Acid Potassium}\\\text{Tartrate.}}}{\begin{matrix}C_4H_4O_6\\HK\end{matrix}} \qquad \underset{\substack{\text{Neutral Potas-}\\\text{sium Tartrate.}}}{\begin{matrix}C_4H_4O_6\\K_2\end{matrix}} \qquad \underset{\substack{\text{Potassio-Sodium}\\\text{Tartrate.}}}{\begin{matrix}C_4H_4O_6\\KNa.\end{matrix}}$$

Tartaric acid contains no water of crystallization. The tartrates are important salts: six are official, four of them being double salts, viz., antimony and potassium tartrate, iron and potassium tartrate, iron and ammonium tartrate, potassium and sodium tartrate; the other two salts are potassium tartrate and potassium bitartrate. Tartrates may be recognized by becoming blackened on the addition of sulphuric acid,

evolving at the same time an empyreumatic odor: their solutions, if neutral, yield with calcium chloride white precipitates of calcium tartrate, which are soluble in solution of potassa. Tartaric acid is recognized by a strong solution producing with a solution of potassium hydrate a white crystalline precipitate of acid potassium tartrate.

Acidum Tartaricum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Nearly or entirely colorless, translucent, monoclinic prisms, or crystalline crusts, or a white powder, permanent in air. When heated for two hours at 100° C. (212° F.), the crystals do not lose more than a trace in weight. At 135° C. (275° F.) they melt; at higher temperatures they are gradually decomposed, emitting the odor of burning sugar, and are finally consumed without leaving more than 0.05 per cent. of ash.	Odorless; purely acid taste; acid reaction.	Cold, 0.8 part. Boiling, 0.5 part.	Cold, 2.5 parts. Boiling, 0.2 part.	250 parts of ether; nearly insoluble in chloroform, benzol, and benzin.

Tests.	Impurities.	Tests for Impurities.
An aqueous solution (1 in 2) of the Acid mixed with a strong solution (1 in 3) of potassium acetate yields a white crystalline precipitate which is soluble in solutions of alkalies and in mineral acids, but insoluble in acetic acid.	Lead and Copper.	A concentrated aqueous solution of Tartaric Acid should not be blackened, at the line of contact, by the careful addition of test-solution of hydrogen sulphide.
	Calcium.	On supersaturating 10 C.c. of the aqueous solution (1 in 10) with ammonia water, no turbidity should be produced in the liquid by ammonium oxalate T.S.,
	Lead, Copper, Iron, etc.	Nor should the further addition to the above solution of 1 drop of ammonium sulphide T.S. produce any dark coloration or precipitate.
To neutralize 3.75 Gm. of Tartaric Acid should require 50 C.c. of potassium hydrate V.S. (each C.c. corresponding to 2 per cent. of the pure acid), phenolphtalein being used as indicator.	Oxalic and Uvic Acids.	An aqueous solution (1 in 10) in which the free acid has been nearly, but not entirely, neutralized by ammonia, should not be affected by calcium sulphate T.S. (*difference from oxalic and uvic acids*).
	Sulphuric Acid.	The aqueous solution (1 in 10) of Tartaric Acid, acidulated with a few drops of hydrochloric acid, should show no precipitate after the addition of barium chloride T.S.

Official Preparation containing Tartaric Acid.

Pulvis Effervescens Compositus . Compound Effervescent Powder (Seidlitz Powder).	Prepared by wrapping 35 grains (2.26 Gm.) of powdered tartaric acid in white paper, and 160 grains (10.3 Gm.) of Seidlitz mixture (composed of 40 grains (2.59 Gm.) of sodium bicarbonate and 120 grains (7.77 Gm.) of Rochelle salt in blue paper. (See Pulveres.)

LIMONIS SUCCUS. *U. S.* Lemon Juice.

The freshly expressed juice of the ripe fruit of *Citrus Limonum* Risso (nat. ord. *Rutaceæ*).

Lemon juice owes its acidity to citric acid (see Acidum Citricum). It is a yellowish, slightly turbid, acid liquid, having a slight odor of lemon, due to the presence of a trace of the volatile oil of the rind. Its specific gravity should be not less than 1.030, and it should contain about 7 per cent. of citric acid. Lemon juice can only with difficulty be preserved. It is generally heated so as to coagulate albuminous matter, and then a small quantity of alcohol is added as an antiseptic.

ACIDUM CITRICUM. *U. S.* Citric Acid.

$H_3C_6H_5O_7.H_2O$; 209.50.

Preparation.—Although this acid is found in many plants, it is obtained upon a commercial scale only from the juice of limes and lemons.[1] It is extracted from *lime-juice* by a very simple process, but one requiring some careful manipulation. The boiling juice is first completely saturated with calcium carbonate (chalk or whiting) in fine powder, and the calcium citrate formed is allowed to subside. This is then washed repeatedly with water, and decomposed by diluted sulphuric acid. An insoluble calcium sulphate is precipitated, and the disengaged citric acid remains in solution. This is carefully concentrated in leaden boilers until a pellicle begins to form, when it is transferred to other vessels to cool and crystallize.

$$\underset{\text{Citric Acid in Lime-Juice.}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Carbonate.}}{3CaCO_3} = \underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\text{Water.}}{3H_2O} + \underset{\text{Carbon Dioxide.}}{3CO_2};$$

then

$$\underset{\text{Calcium Citrate.}}{Ca_32C_6H_5O_7} + \underset{\text{Sulphuric Acid.}}{3H_2SO_4} = \underset{\text{Citric Acid.}}{2H_3C_6H_5O_7} + \underset{\text{Calcium Sulphate.}}{3CaSO_4}.$$

Acidum Citricum. U.S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvent.
Colorless, translucent, right-rhombic prisms, not deliquescent except in moist air, efflorescent in warm air.	Odorless; agreeable acid taste; acid reaction.	Cold, 0.63 part. Boiling, 0.4 part.	Cold, 1.61 parts. Boiling, 1.43 parts.	Ether 18 parts.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
When heated to about 75° C. (167° F.), the Acid begins to lose its water of crystallization; at about 135° C. (275° F.) it becomes anhydrous, and melts between 135° and 152° C. (275° and 305.6° F.). When slowly ignited, it is gradually decomposed without emitting the odor of burning sugar (difference from *tartaric acid*), and is finally consumed without leaving more than 0.05 per cent. of ash. On adding 1 C.c. of an aqueous solution (1 in 10) of the Acid to 50 C.c. of calcium hydrate T.S. (or so much more of the latter that the mixture has an alkaline reaction), the liquid remains clear until boiled, when it becomes opaque through the precipitation of calcium citrate, which redissolves on cooling.	Tartaric or Oxalic Acid.	If 1 Gm. of the powdered Acid be dissolved in 5 C.c. of a cold solution (1 in 3) of potassium acetate, the liquid should remain clear even after the addition of an equal volume of alcohol.
	Calcium.	On mixing 10 C.c. of a 10-per-cent. aqueous solution of the Acid with a quantity of ammonia water insufficient to neutralize it completely, and adding to one-half of this liquid 1 C.c. of ammonium oxalate T.S., it should remain clear.
	Metallic Impurities.	The other half of the above solution, mixed with a few C.c. of hydrogen sulphide T.S., should not deposit a colored precipitate, nor acquire more than a faintly brownish-yellow tint.
To neutralize 3.5 Gm. of the Acid should require 50 C.c. of potassium hydrate V.S. (each C.c. corresponding to 2 per cent. of the pure acid), phenolphthalein being used as indicator.	Sulphuric Acid.	10 C.c. of a 1-per-cent. aqueous solution of the Acid should show no turbidity within five minutes after the addition of 1 C.c. of barium chloride T.S. and a few drops of hydrochloric acid.

[1] Limes—the fruit of *Citrus acris*—are usually smaller than lemons, and abound in a very acid juice.

Citric acid contains one molecule of water of crystallization: it differs in this respect from tartaric acid, which contains none. It is a tribasic acid; in other words, three atoms of hydrogen are replaceable by metals, three classes of citrates being formed according as one, two, or three hydrogen atoms are replaced.

The citrates are a valuable class of medicinal salts, ten being official, —six of which are simple salts and four are double,—as follows: effervescent lithium citrate, bismuth, iron, lithium, and potassium citrates, magnesium citrate, bismuth and ammonium citrate, iron and ammonium citrate, iron and quinine citrate, iron and strychnine citrate. It is used in three solutions,—solution of ferric citrate, solution of magnesium citrate, solution of potassium citrate.

Uses.—Citric acid in solution is used as a substitute for lemon juice. The dose is from five to thirty grains (0.3 to 1.9 Gm.). It is rarely given in its free state.

Official Preparation.

Syrupus Acidi Citrici. Syrup of Citric Acid.	Made by mixing 10 C.c. of spirit of lemon with 980 C.c. of syrup, and adding gradually a solution of 10 Gm. of citric acid in 10 C.c. of water (see page 300).

TAMARINDUS. *U. S.* Tamarind.

The preserved pulp of the fruit of *Tamarindus indica* Linné (nat. ord. *Leguminosæ*).

Among the constituents of the pulp of tamarinds are citric and tartaric acids: malic acid is present in small quantity.

Uses.—This pulp is one of the ingredients in confection of senna: it is purgative, and is often used to make laxative confections.

RHUS GLABRA. *U. S.* Rhus Glabra.

The fruit of *Rhus glabra* Linné (nat. ord. *Anacardieæ*).

This fruit owes its acidity to malic acid, which exists in it as calcium and potassium malate: this acid is found in unripe apples and in a great number of fruits, roots, leaves, stems, etc. Rhus glabra also contains tannin, gallic acid, and red coloring-matter.

Malic acid may be obtained from rhus glabra by exhausting the berries with water, evaporating, filtering, and crystallizing the acid calcium malate, which is then dissolved in boiling water, and treated with lead acetate, when lead malate is precipitated; this is then suspended in water, hydrogen sulphide is passed through it, lead sulphide is precipitated, and the solution of malic acid is evaporated to permit crystallization. Malic acid is found in colorless shining needles having a sour taste and an acid reaction. It is soluble in alcohol and deliquescent in the air. It is dibasic.

Uses.—Rhus glabra is a useful refrigerant and astringent. The dose is thirty grains to two drachms (1.9 to 7.7 Gm.).

Official Preparation.

Extractum Rhois Glabræ Fluidum. Fluid Extract of Rhus Glabra.	Made with 10 per cent. of glycerin and a menstruum of diluted alcohol (see page 419).

Acid Saccharine Fruits containing Pectinous Bodies.

The pulpy constituents of fruits and fleshy roots undergo naturally certain changes when subjected to the influences of a ferment known as *pectase:* these changes can be closely imitated artificially when the pulp is treated with acids or alkalies in aqueous solution, by the aid of heat. According to Fremy, pectase exists in fruits in either a soluble or an insoluble condition. Green unripe fruits contain *pectose*, a substance which is supposed to be isomeric with cellulin, and which gives to such fruits their hardness. Pectose is insoluble in water, alcohol, or ether.

In the process of ripening fruits, the pectase slowly acts on the pectose, the hardness disappears, *pectin* is formed, and the fruit is soft and ripe. When it is overripe, *parapectin* and *metapectic acid* are produced. The moderate action of heat and water upon fruits is thus explained: the citric, tartaric, or malic acid in the fruit acts on the pectose, softening it, and converting it into pectin, and the pectin is then acted upon by the ferment pectase, which causes it to gelatinize, on cooling, through the production of pectosic acid: this is the cause of the formation of fruit jellies. The *rapid* application of strong heat to the pulp of fruits results in the coagulation and destruction of the ferment pectase, and the production of jelly is thus prevented.

Alkalies form soluble compounds with pectosic acid and pectin, and hence, when gelatinous precipitates are found in fluid extracts and tinctures, due to the formation of either of these substances, they may be dissolved by the application of an alkaline solution: the use of ammonia water in fluid extract of senega is an illustration of this.

RUBUS IDÆUS. *U. S.* Raspberry.

The fruit of *Rubus idæus* Linné (nat. ord. *Rosaceæ*).

This fruit contributes to pharmacy an agreeable juice, which is used in making the official syrup. The average constituents are 3 to 5 per cent. sugar, 1 per cent. free acid, 1 per cent. albuminous substances, and 2 to 5 per cent. pectinous bodies.

Official Preparation.

Syrupus Rubi Idæi . Syrup of Raspberry.	Express the juice from fresh ripe raspberries, allow it to stand until it ferments, then filter it, and add 60 parts of sugar to 40 parts of the filtered liquid, heat to boiling, and strain (see page 309).

Unofficial Fruits.

Apple.	The fruit of *Pyrus malus*. The constituents are 7 to 10 per cent. sugar, ½ to 1 per cent. free acid, and 5 per cent. each albuminous and pectinous substances. The fermented juice of the apple is termed *cider* or *vinegar*.
Apricot.	The fruit of *Prunus Armeniaca*. The average constituents are 1 to 2 per cent. sugar, ½ to 1 per cent. free acid, ½ to 1 per cent. albuminous substances, and 5 to 10 per cent. pectinous substances.
Blackberry.	The fruit of *Rubus villosus*, *R. canadensis*, and *R. trivialis*. The average constituents are 4 per cent. sugar, 1 per cent. free acid, ½ per cent. albuminous substances, and 1 to 1½ per cent. pectinous substances.
Bilberry.	The fruit of *Vaccinium resinosum*. The average constituents are 5 per cent. sugar, 1 per cent. free acid, 1 per cent. albuminous substances, and ½ per cent. pectinous substances.
Cherry.	The fruit of a species of *Prunus*. The average constituents are 8 to 13 per cent. sugar, 1 per cent. free acid, and ½ to 3 per cent. each albuminous and pectinous substances.

Unofficial Fruits.—*Continued.*

Currant.	The fruit of *Ribes rubrum*. The average constituents are 4 to 7 per cent. sugar, 1 to 2 per cent. free acid, ½ to ½ per cent. albuminous substances, and ½ per cent. pectinous substances.
Gooseberry.	The fruit of *Ribes Grossularia*. The average constituents are 6 to 8 per cent. sugar, 1 to 1½ per cent. free acid (chiefly citric), ½ per cent. albuminous substances, and ½ to 2 per cent. pectinous substances.
Peach.	The fruit of *Amygdalus Persica*. The average constituents are 1½ per cent. sugar, ½ per cent. free acid, ½ per cent. albuminous substances, and 6 per cent. pectinous substances.
Pear.	The fruit of *Pyrus communis*. The average constituents are 7 per cent. sugar, 7 per cent. free acid, ½ per cent. albuminous substances, and 3 per cent. pectinous substances.
Pineapple.	The fruit of *Ananassa sativa*. The juice contains 2 per cent. sugar, 1 per cent. free acid, and 3 per cent. albuminous and pectinous substances.
Plum.	The fruit-trees belonging to the genus *Prunus*. The average constituents are about 1 to 2 per cent. sugar, ½ to 1 per cent. free acid, ½ per cent. albuminous substances, and 2 to 11 per cent. pectinous substances.
Strawberry.	The fruit of different species of *Fragaria*. The average constituents are 3 to 7 per cent. sugar, 1 per cent. free acid, ½ per cent. albuminous substances, and 2 per cent. pectinous substances.

QUESTIONS ON CHAPTER LIV.

PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS.

What is white wine? Describe it and give its specific gravity.

What is red wine? Describe it and give its specific gravity. What is must?

How is wine made?

What is meant by the following terms as applied to wines?—viz.: Sweet, dry, light, generous, sparkling, still, sour, rough.

What kinds of wine are official?

Describe odor, taste, chemical reaction, and solubility. How may the alcoholic strength of wine be ascertained?

How much alcohol should wine contain?

White wine—How may the following impurities be detected?—viz.: Tannic acid; limit of fixed residue; limit of acidity.

Red wine—How may the following impurities be detected?—viz.: Limit of acidity; aniline coloring.

What is the aroma of wines termed, and upon what does it depend?

What ethers are said to formed in wines?

What are argols?

What is the difference between red and white argols?

Why are argols deposited during the clarification of wine?

What salt is obtained from argols?

What are the uses of wine?

What alcoholic strength is required of wine for pharmaceutical purposes?

How is it obtained, and why is it required?

Brandy—What is the Latin official name? What is its official definition?

Describe the best kind.

What kind of brandy is recognized by the U. S. Pharmacopœia?

How much alcohol should brandy contain?

Give description and specific gravity. Describe odor, taste, and chemical reaction.

How may the following impurities be detected?—viz.: Fusel oil from grain or potato spirit; an undue amount of solids; added sugar, glycerin, or spices; traces of oak tannin from casks; an undue amount of free acid.

To what does brandy owe its aroma?

What is œnanthic ether chemically, and what is its commercial name?

Is any preparation of brandy official?
What is its medicinal use?
Tartaric acid—What is the Latin name? Give formula in symbols and molecular weight.
How is it prepared? Describe rationale of process.
What is its quantivalence?
Does it contain water of crystallization?
What tartrates are official?
How may they be recognized?
How may tartaric acid be recognized? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Lead and copper; lead, copper, and iron; copper; sulphuric acid.
What official preparation contains tartaric acid?
To what does lemon juice owe its acidity?
How much acid should it contain?
What should be its specific gravity?
What official preparations are made with lemon juice?
Citric acid—What is the Latin name? Give formula in symbols and molecular weight.
How is this acid obtained commercially? Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Tartaric and oxalic acids; 1 per cent. or more of tartaric acid; lead or copper; copper; lead, copper, and iron; sulphuric acid.
How much water of crystallization does it contain?
What is its quantivalence? What citrates are official?
What is the dose? What official preparation is made with it?
What is tamarind?
What acids are contained in the pulp of tamarinds?
For what is it used?
Sumach—What is the Latin official name? What is it?
To what does it owe its acidity?
How may malic acid be obtained from it?
What is the quantivalence of malic acid?
For what is rhus glabra used, and what is the dose?
What official preparation is there of it?
What is pectase, and what is pectose?
To what substance do green, unripe fruits owe their hardness?
In the ripening of fruits, what change takes place whereby the fruits are rendered soft?
When fruit is over-ripe, what substances are produced?
How is the formation of fruit jellies explained?
What action do alkalies have upon pectosic acid and pectin?
Give an illustration of the application of this principle.
Raspberry—What is the Latin official name? What part is official?
Into what official preparation does it enter? How is this made?

CHAPTER LV.

VOLATILE OILS.

VOLATILE oils, or *essential oils*, are found in the various parts of plants. They usually constitute the odorous principles, and they either pre-exist in the plant, or are produced by the reaction of certain constituents when brought in contact with water. Volatile oils are sometimes formed through destructive distillation, as the oil of amber, and may also be obtained from the animal kingdom, as the oil from ambergris. They may be divided into four classes: 1. Terpenes. 2. Oxygenated oils. 3. Sulphurated oils. 4. Nitrogenated oils.

1. **Terpenes**, or hydrocarbons, consist of carbon and hydrogen, and mostly have the formula $C_{10}H_{16}$, oil of turpentine being the type.

2. **Oxygenated Oils.**—Hydrocarbons containing oxygen, like the oil of cinnamon.

3. **Sulphurated Oils.**—Containing sulphur, like the volatile oil from mustard.

4. **Nitrogenated Oils.**—A very small class containing hydrocyanic acid, like oil of bitter almond; otherwise, nitrogen is never one of the constituents of volatile oils.

Proximately, volatile oils consist of two principles, which differ in their point of volatilization or congelation, or in their composition. They are termed *stearopten* and *eleopten*. It is, however, impossible to separate these by distillation alone so as to obtain them entirely pure. When, as often happens, they congeal at different temperatures, they may be separated by compressing the frozen oil between folds of bibulous paper. The solid matter, stearopten, remains within the folds, and the fluid, eleopten, is absorbed by the paper, from which it may be separated by distillation with water. The solid crystalline substances deposited by volatile oils upon standing are also called stearoptens. Some of them are denominated *camphors*, from their resemblance to true camphor. Some are isomeric with the oils in which they are formed; others are oxides or hydrates, alcohol-like in character. Certain oils, under the influence of water, deposit crystalline hydrates of the respective oils.

Color of Volatile Oils.—Most oils are colorless when pure and fresh, or can be made colorless by redistillation. Upon exposure to the air they acquire various colors, becoming green, as in oil of wormwood, yellow, as in oil of peppermint, red, as in oil of origanum, brown, as in oil of cinnamon, or blue, as in oil of chamomile.

Odor.—The odor of volatile oils is very variable. It is their most characteristic feature. It is sensibly modified by the exposure of the

oils to the air. Oil of turpentine may be rectified by distillation in an atmosphere of carbonic acid, or *in vacuo*, so that it will be odorless, or have an agreeable fragrant odor. A very slight exposure to the air is sufficient, however, to restore the well-known unpleasant odor.

Taste.—Their taste is almost as variable as their odor. Some are sweet, others have a mild, pungent, hot, acrid, caustic, or burning taste.

Density.—The specific gravity of volatile oils also varies (from 0.847 to 1.17). They are mostly lighter than water (see table, page 88).

Boiling Point.—This is also variable. The oils volatilize to some extent at ordinary temperatures and diffuse their peculiar odors. Upon heating, however, they may be completely vaporized. When sufficiently heated, they take fire, and burn with a bright flame.

Solubilities.—Water is a poor solvent for volatile oils, although it acquires a decided odor and flavor when brought in contact with the oil in a finely-divided state, as has been shown in the medicated waters. Alcohol, ether, chloroform, naphtha, glacial acetic acid, benzin, and benzol are solvents for volatile oils. Alcohol is a better solvent for the oxygenated oils than for the terpenes. Volatile oils freely dissolve fixed oils, fats, resins, camphors, sulphur, phosphorus, and similar bodies.

Exposure to Light and Air injures the quality and destroys the fragrance of volatile oils. Ozone is developed, and they thicken and become resinified, or deposit crystalline compounds upon exposure. The whitening of corks which have been inserted in bottles containing volatile oils and kept a long time is due to the bleaching action of the ozone which is gradually produced during their decomposition. They should be kept in tightly-stoppered, amber-colored vials.

Action of Acids, Alkalies, etc.—Nitric acid, if strong, decomposes volatile oils with great rapidity. Iodine reacts with some oils with explosive violence. Alkalies have generally little effect on volatile oils, with the exception of a few with which it forms chemical compounds, like the oils from cloves, gaultheria, cinnamon, etc.

Adulterations.—The volatile oils are costly enough to tempt the cupidity of those who make a business of adulterating. A fixed oil is sometimes used to mix with the volatile oil. This mixture may be detected by dropping the suspected oil on a piece of filtering-paper. The stain of a pure volatile oil is not permanent. By slightly heating it the oil is vaporized; if fixed oil is present, the stain remains. Alcohol may be detected by shaking the mixed oil in a graduated tube with glycerin or water. The volume of the oil will be diminished, and that of the water or glycerin correspondingly increased, in proportion to the amount used. This test is not susceptible of fine determination, because of the slight solubility of volatile oils in water and in mixtures of alcohol and water. Metallic sodium, calcium chloride, aniline red, have all been used to show the presence of alcohol and traces of water in volatile oils. The adulteration of volatile oils by the addition of cheaper grades of the same oil, or by using a cheaper oil having a similar odor, is largely practised. The only reliable test here is the use of the olfactories. By practice the sense of smell can be highly educated by the analyst. The specific rotatory power, the index of refraction, the amount of iodine absorbed, and the saponification num-

ber, or the amount of potassium hydrate absorbed by the ester to form a potassium salt, have all been used with more or less success in detecting adulterations.

Preparation of Volatile Oils.

Volatile oils are generally obtained from plants by the following methods: 1. Distillation with water. 2. Distillation *per se*. 3. Expression. 4. Solution.

1. **Distillation with Water.**—This is the method most frequently employed. The general formula is as follows: Put the substance from which the Oil is to be extracted into a still (see Distillation, page 166), and add enough water to cover it; then distil by a regulated heat into a large refrigeratory. Separate the Distilled Oil from the water which comes over with it.

The substances from which the volatile oils are extracted may be employed in either the recent or the dried state. Certain flowers, however, such as orange flowers and roses, must be used fresh, or preserved with salt or by means of glycerin, as they afford little or no oil after desiccation. Dried substances, before being submitted to distillation, require to be macerated in water till they are thoroughly penetrated by this fluid; and, to facilitate the action of the water, it is necessary that, when of a hard or tough consistence, they should be properly comminuted.

The water which is put with the substance to be distilled into the still, answers the double purpose of preventing the decomposition of the vegetable matter by regulating the temperature, and of facilitating the volatilization of the oil, which, though in most instances it readily rises with the vapor of boiling water, requires, when distilled alone, a considerably higher temperature, and is at the same time liable to be partly decomposed. Some oils, however, will not ascend readily with steam at 100° C. (212° F.), and in the distillation of these it is customary to use water saturated with common salt, which does not boil under 118.4° C. (227.1° F.) (see page 120). Other oils, again, may be volatilized with water at a temperature below the boiling point; and, as heat exercises an injurious influence over the oils, it is desirable that the distillation should be effected at as low a temperature as possible. To prevent injury from heat, it has been recommended to suspend the substance containing the oil in a basket, or to place it upon a perforated shelf, in the upper part of the still, so that it may be penetrated by the steam without being in direct contact with the water. Another mode of effecting the same object is to distil it *in vacuo*. Steam can be very conveniently applied to this purpose by causing it to pass through a coil of tube, of an inch or three-quarters of an inch bore, placed in the bottom of a common still (see page 133). The end at which the steam is admitted enters the still at the upper part, and the other end, at which the steam and condensed water escape, passes out laterally below, being furnished with a stopcock, by which the pressure of the steam may be regulated, and the water drawn off when necessary. In some instances it is desirable to conduct the steam immediately into the still near the bottom, by which the contents are kept in a state of brisk ebullition (see Fig. 102).

The quantity of water added is not a matter of indifference. An

amount above what is necessary acts injuriously, by holding the oil in solution, when the mixed vapors are condensed; and if the proportion be very large, it is possible that no oil whatever may be obtained separate. On the contrary, if the quantity be too small, the whole of the oil will not be distilled, and there will be danger of the substance in the still adhering to the sides of the vessel and thus becoming burnt. The cage shown on page 168 will be found useful in this connection. Sometimes the quantity of oil is so small that it entirely dissolves in the water, and then the process of *cohobation* is applicable: this consists in repeatedly returning the distillate to a fresh portion of the plant, the water in this way becoming supersaturated, and then the oil can be separated.

2. **Distillation** *per se.*—By this is meant the distillation of certain bodies without the use of water (*per se*, "by itself"). This is done in the cases of certain oleoresins, oils, copaiba, etc., water not being required in the process, and always being difficult to separate from the distillate.

3. **Expression** (see page 246).—This method generally produces the most fragrant products, because there are very few volatile oils whose aroma is not injuriously affected by the action of heat. The volatile oils of the Rutaceæ are mostly made by expressing the rind of the fresh fruit (see page 857).

4. **Solution or Absorption.**—Some volatile oils are so susceptible to decomposition that they are dissociated by distillation, whilst they do not exist in sufficient quantity in the plant to pay for their extraction by expression: in such cases the odorous principle may be extracted by some form of solution or absorption. This may be effected by maceration, digestion, percolation with carbon bisulphide or similar solvent, enfleurage, or the pneumatic process.

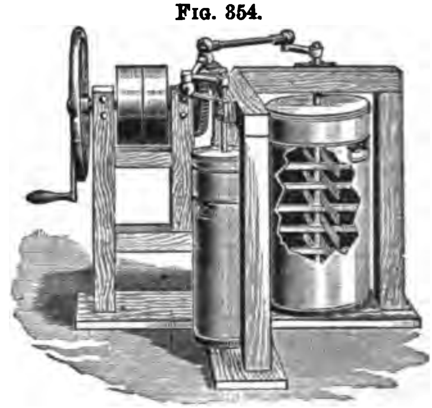
Maceration.—In obtaining volatile oils by maceration, the odorous portions of the plant (generally fragrant flowers) are allowed to stand in contact with a bland inodorous fixed oil, like fine olive oil, oil of ben, or purified cotton-seed oil: the oil absorbs the odor, and after a certain length of time it is strained. The odorous fixed oil is generally used in perfumery.

Digestion.—This process is similar to maceration, except that a moderate heat is employed, by the use of a salt-bath, to aid in the extraction.

Enfleurage is largely used for extracting the odors of very delicate flowers. It is a cold process, and consists in spreading a thin layer of purified inodorous fat upon glass frames (*châssis*): these resemble an ordinary window-sash, with one pane of glass in each. The flowers are sprinkled on the fat, and the frames piled in a stack. The whole is left undisturbed for a time varying from twelve hours to four days. The fat absorbs the odor completely. When strong pomades are desired, fresh flowers are continually added as long as the absorption continues, and the pomades are known commercially as Nos. 6, 12, 18, and 24, the numbers indicating the strength. The volatile products may be obtained from the pomade by chopping the latter into small pieces and macerating them in pure alcohol. A small portion of the fat is apt to be dissolved by this treatment and give a fatty odor to the solution, but this may be separated by subjecting it to cold, when it can be filtered out.

The process of extracting odors from pomades by agitating them in contact with alcohol has been largely used in late years in the United States. The pomades are mostly imported from Grasse, France, and Fig. 354 illustrates Day's pomade washer, a machine constructed for agitating the mixture of pomade and alcohol in order to hasten the process of extraction.

FIG. 354.



Day's pomade washer.

Pneumatic Process.—This method is used only with very delicate volatile oils. It consists in forcing a current of air into a vessel filled with fresh flowers, and then conveying the perfumed air into another vessel containing purified fat which is kept melted. Circular plates, half immersed, revolve in the fat, and these, when coated, absorb the odor from the perfumed air.

Percolation.—This process consists in percolating odorous flowers with purified carbon disulphide: the latter is distilled, and the volatile oils are found in the residue.

Official Products from the Rutaceæ.

The natural order Rutaceæ furnishes valuable products to medicine and pharmacy, which are conveniently grouped together.

AURANTII DULCIS CORTEX. *U.S.* Sweet Orange Peel.

The rind of the fresh fruit of *Citrus Aurantium* Linné (nat. ord. *Rutaceæ*).

Sweet orange peel owes its virtues to the volatile oil found in the epidermis. It also communicates a yellowish color to the preparations made with it. It is used as a flavoring substance.

Official Preparations.

Syrupus Aurantii . . . . Syrup of Orange.	Made by digesting grated fresh sweet orange peel with a little boiling alcohol, making a medicated water by the aid of precipitated calcium phosphate, and dissolving sugar in it by agitation (see page 302).
Tinctura Aurantii Dulcis . . . . Tincture of Sweet Orange Peel.	Made by percolating 200 Gm. of sweet orange peel with sufficient alcohol to make 1000 C.c. (see page 361). Dose, one fluidrachm (3.7 C.c.).

AURANTII AMARI CORTEX. *U.S.* Bitter Orange Peel.

The rind of the fruit of *Citrus vulgaris* Risso (nat. ord. *Rutaceæ*).

The peel from the bitter orange contains *hesperidin* and a small quantity of volatile oil. It is not used to communicate flavor, but as a bitter tonic. The dose is ten to forty grains (0.6 to 2.6 Gm.).

Official Preparations.

Extractum Aurantii Amari Fluidum . Fluid Extract of Bitter Orange Peel.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 396). Dose, half a fluidrachm (1.8 C.c.).
Tinctura Aurantii Amari . . . . . . Tincture of Bitter Orange Peel.	Made by exhausting 200 Gm. of bitter orange peel with sufficient menstruum, made by mixing 3 parts of alcohol and 2 parts of water, to make 1000 C.c. (see page 361). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

OLEUM AURANTII CORTICIS. *U.S.* Oil of Orange Peel.

A volatile oil obtained by expression from the fresh peel of either the Bitter Orange, *Citrus vulgaris* Risso, or the Sweet Orange, *Citrus Aurantium* Linné (nat. ord. *Rutaceæ*).

This oil is of a pale yellowish color, and has the composition of the terpenes, $C_{10}H_{16}$. Its sp..gr. is 0.850. It is soluble in alcohol, and may be preserved by shaking it with one-fourth of its volume of water, separating, and mixing with five times its measure of alcohol. It is very prone to decomposition, and rapidly acquires a terebinthinate odor. It is used in making cologne water and bay rum, and to flavor elixirs.

Official Preparations.

Spiritus Aurantii . . . . Spirit of Orange.	Made by dissolving 50 C.c. of oil of orange peel in 950 C.c. of deodorized alcohol (see page 330). Dose, one fluidrachm (3.7 C.c.).
Spiritus Aurantii Compositus . Compound Spirit of Orange.	Made by dissolving 200 C.c. oil of orange peel, 50 C.c. oil of lemon, 20 C.c. oil of coriander, and 5 C.c. oil of anise, in enough deodorized alcohol to make 1000 C.c. Used in making Aromatic Elixir, U.S.P.

OLEUM AURANTII FLORUM. *U.S.* Oil of Orange Flowers.

[OIL OF NEROLI.]

A volatile oil distilled from the fresh flowers of the Bitter Orange, *Citrus vulgaris* Risso (nat. ord. *Rutaceæ*).

This is a brownish-yellow, very fragrant terpene ($C_{10}H_{16}$). Sp. gr. 0.875 to 0.890. It is soluble in an equal volume of alcohol, and is well preserved by this addition. If a little alcohol be poured on the surface of the oil and the mixture gently undulated, a bright violet fluorescence will be observed. In contact with a saturated solution of sodium bisulphite, it assumes a handsome and permanent purplish-red color. This oil as found in the market is very variable in quality. The best comes from Nice, and is derived from the flowers of the *Citrus Aurantium*, or sweet orange, by distillation with water: this is called *néroli pétale.* The next quality is obtained in the same way, but by using the blossoms of the *Citrus Bigaradia*, or bitter orange: this is called *néroli bigarade.* An inferior sort, *essence de petit grain*, is made by distilling the leaves and unripe fruit.

Uses.—This oil is almost exclusively used in perfumery.

LIMONIS CORTEX. *U.S.* Lemon Peel.

The rind of the recent fruit of *Citrus Limonum* Risso (nat. ord. *Rutaceæ*).

Lemon peel is principally used to communicate flavor and color to spirit and syrup of lemon. It contains volatile oil and *hesperidin.*

OLEUM LIMONIS. *U. S.* Oil of Lemon.

A volatile oil obtained by expression from fresh Lemon Peel.

This important volatile oil is a terpene, $C_{10}H_{16}$: when fresh it has the fragrant odor of lemons. Sp. gr. 0.858. It is soluble in three parts of alcohol, in glacial acetic acid, and in all proportions in absolute alcohol. It may be preserved from the effects of oxidation by the addition of 5 per cent. of alcohol and separation from the sediment.

Official Preparation.

Spiritus Limonis . . . Spirit of Lemon. Essence of Lemon.	Made by dissolving 50 C.c. of oil of lemon in 950 C.c. of deodorized alcohol to which 50 Gm. of freshly grated lemon peel are added. This spirit is used in flavoring syrup of citric acid (see page 332).

OLEUM BERGAMOTTÆ. *U. S.* Oil of Bergamot.
[OLEUM BERGAMII, PHARM. 1880.]

A volatile oil obtained by expression from the rind of the fresh fruit of *Citrus Bergamia* Risso et Poiteau (nat. ord. *Rutaceæ*).

This is an important volatile oil commercially, although it is not used medicinally. It derives its name from Bergamo, a city of Italy, and is largely produced in that country. It is a terpene ($C_{10}H_{16}$). Sp. gr. from 0.880 to 0.885. It is soluble in all proportions in alcohol and glacial acetic acid. This oil is often prepared by expression, although the sponge process is at present largely used. The *ecuelle* (Fig. 355) is a convenient instrument for rapidly rupturing the oil-vesicles: it is held in one hand by the operator, whilst with the other hand the bergamot, lemon, or orange fruit is skilfully rotated on the sharp points: the oil flows into the gutter in the cup, and then through the hollow handle into a suitable vessel. Oil of bergamot is used solely for its perfume.

FIG. 355.

Ecuelle.

Official Products from the Labiatæ.

The natural order of the mints is a strongly marked group, the members of it being remarkable for their botanical analogy with one another and for the similarity of their chemical constituents.

MENTHA PIPERITA. *U. S.* Peppermint.

The leaves and tops of *Mentha piperita* Smith (nat. ord. *Labiatæ*).

Its properties are due to the presence of about two per cent. of volatile oil. It is largely cultivated, and is a grateful aromatic stimulant.

OLEUM MENTHÆ PIPERITÆ. *U. S.* Oil of Peppermint.

A volatile oil distilled from Peppermint.

It is a colorless or yellowish liquid, having the characteristic strong odor of peppermint, a strongly aromatic taste, followed by a sensation of

cold when air is drawn into the mouth, and a neutral reaction. Sp. gr. about 0.900. It is soluble in an equal weight of alcohol.

Oleum Menthæ Piperitæ. U. S.	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A colorless, or yellowish, or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air. Specific gravity 0.900 to 0.920 at 15° C. (59° F.). The Oil does not fulminate with iodine.	Characteristic strong odor of peppermint; strongly aromatic, pungent taste, followed by a sensation of cold when air is drawn into the mouth; neutral reaction.	Forms a clear solution with an equal volume, becoming turbid when somewhat further diluted.	Soluble in all proportions in carbon disulphide and in glacial acetic acid.

Tests for Identity.	Impurities.	Tests for Impurities.
If 5 drops of the Oil be added to 1 C.c. of glacial acetic acid, and the mixture gently warmed, the liquid will assume a blue color, with a red fluorescence. If 2 C.c. of the Oil be mixed with 1 C.c. of glacial acetic acid, and 1 drop of nitric acid be added, the liquid will soon acquire a green, greenish-blue, blue, or violet tint, with a copper-red fluorescence. If 1 C.c. of the Oil be dissolved in 5 C.c. of alcohol, 0.5 Gm. of sugar and 1 C.c. of hydrochloric acid added, and the mixture gently heated, a deep blue or violet color will gradually be produced.	Oil of Camphor and Oil of Sassafras.	If to 5 C.c. of nitric acid 1 drop of the Oil be added, and the mixture gently agitated, and allowed to stand for about three hours, it should have a yellowish, but not a bright red, color.
	Distinction from Dementholized Oil.	If a portion of the Oil, contained in a test-tube, be placed in a freezing mixture of snow (or pounded ice) and salt for fifteen minutes, it should become cloudy and thick, and after the addition of a few crystals of menthol, being still exposed to cold, it should soon form a crystalline mass.
	Alcohol.	When heated on a water-bath, in a flask provided with a well-cooled condenser, the Oil should not yield a distillate having the characters of alcohol.

Official Preparations.

Aqua Menthæ Piperitæ . . . Made by adding 2 C.c. of oil of peppermint to 4 Gm. of precipitated calcium phosphate and filtering with distilled water until 1000 C.c. have been obtained (see page 291).
Peppermint Water.

Spiritus Menthæ Piperitæ . Made by dissolving 100 C.c. of oil of peppermint in 900 C.c. of alcohol in which 10 Gm. of peppermint have been macerated (see page 332). Dose, twenty minims (1.2 C.c.).
Spirit of Peppermint.

Trochisci Menthæ Piperitæ . Each troche contains ⅙ minim of oil of peppermint (see Part V.).
Troches of Peppermint.

MENTHOL. *U. S.* Menthol.

$C_{10}H_{19}OH = 155.66.$

A stearopten (having the character of a secondary alcohol), obtained from the official oil of peppermint (from *Mentha piperita* Smith), or from Japanese or Chinese oil of peppermint (from *Mentha arvensis* Linné, var. *piperascens* Holmes, and *Mentha canadensis* Linné, var. *glabrata* Holmes; nat. ord. *Labiatæ*)

The oil of peppermint owes its odor to *menthol* ($C_{10}H_{20}O$), a stearopten obtained from it through fractional distillation, cooling, and crystallization.

Menthol. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, acicular or prismatic crystals. It melts at 43° C. (109.4° F.) to a colorless liquid; boils at 212° C. (413.6° F.), and volatilizes slowly at the ordinary temperature.	Strong and pure odor of peppermint; warm, aromatic taste, followed by a sensation of cold when air is drawn into the mouth.	Slightly soluble, imparting its odor and taste.	Freely soluble.	Freely soluble in ether, chloroform, carbon disulphide, or glacial acetic acid.

Tests for Identity.	Impurities.	Tests for Impurities.
When triturated with about an equal weight of camphor, thymol, or chloral hydrate, the mixture becomes liquid.	Wax, Paraffin, or Inorganic Substances.	If a little Menthol be heated in an open capsule, on a water-bath, it should gradually volatilize without leaving any residue.
Its alcoholic solution is neutral to litmus paper, and deviates polarized light to the left.	Thymol.	If a few crystals of Menthol be dissolved in 1 C.c. of glacial acetic acid, and then 3 drops of sulphuric acid and 1 drop of nitric acid added, no green color should be produced.

Uses.—Menthol is largely used, compressed into cones, as a local remedy in neuralgia and headache.

MENTHA VIRIDIS. *U. S.* Spearmint.

The leaves and tops of *Mentha viridis* Linné (nat. ord. *Labiatæ*).

The volatile oil is the only constituent of importance in this plant; the yield is from ½ to 1 per cent.

OLEUM MENTHÆ VIRIDIS. *U. S.* Oil of Spearmint.

A volatile oil distilled from Spearmint.

It is a colorless or yellowish liquid, having the characteristic strong odor of spearmint, a hot, aromatic taste, and a neutral reaction. Sp. gr. 0.930 to 0.940. It is soluble in an equal volume of alcohol.

Oil of spearmint contains an oxygenated oil, $C_{10}H_{14}O$, which is the odorous portion, and a terpene, $C_{10}H_{16}$. It is used as a stimulant and carminative.

Official Preparations.

Aqua Menthæ Viridis . . . Made by adding 2 C.c. of oil of spearmint to 4 Gm. of precipitated calcium phosphate, and filtering with distilled water until 1000 C.c. have been obtained (see page 292).
Spearmint Water.

Spiritus Menthæ Viridis . . Made by dissolving 100 C.c. of oil of spearmint in 900 C.c. of alcohol in which 10 Gm. of spearmint have been macerated (see page 332). Dose, twenty minims (1.2 C.c.).
Spirit of Spearmint.

OLEUM LAVANDULÆ FLORUM. *U. S.* Oil of Lavender Flowers.

A volatile oil distilled from the fresh flowers of *Lavandula officinalis* Chaix (nat. ord. *Labiatæ*).

It is a colorless or yellowish liquid, having the fragrant odor of lavender flowers, a pungent and bitterish taste, and a neutral reaction while fresh. Sp. gr. 0.885 to 0.897. It is readily soluble in alcohol and in

acetic acid of 90 per cent. or over. "It is soluble in three times its volume of a mixture of three volumes of alcohol and one volume of water (distinction from, and absence of, oil of turpentine)."

When heated to about 80° C. (176° F.), it should not yield a colorless distillate having the characteristics of alcohol.

Oil of lavender flowers is most largely used in perfumery. The best quality is distilled at Mitcham, England. It has the same composition and properties as oil of lavender: it is more fragrant and more expensive.

Official Preparations.

Spiritus Lavandulæ . . . . Spirit of Lavender.	Made by dissolving 50 C.c. of oil of lavender flowers in 950 C.c. of deodorized alcohol (see page 332). Dose, one fluidrachm (3.7 C.c.).
Tinctura Lavandulæ Composita . . Compound Tincture of Lavender.	Made by dissolving 8 C.c. of oil of lavender flowers and 2 C.c. of oil of rosemary in 700 C.c. of alcohol and 250 C.c. of water, percolating 5 Gm. of cloves, 20 Gm. of cinnamon, 10 Gm. of nutmeg, and 10 Gm. of red saunders with the liquid, and adding sufficient diluted alcohol to obtain 1000 C.c. (see page 371). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

OLEUM ROSMARINI. *U.S.* Oil of Rosemary.

A volatile oil distilled from the leaves of *Rosmarinus officinalis* Linné (nat. ord. *Labiatæ*).

It is a colorless or yellowish liquid, having the characteristic pungent odor of rosemary, a warm, somewhat camphoraceous taste, and a neutral or faintly acid reaction. Sp. gr. 0.895 to 0.915. It is soluble in alcohol and in an equal volume of glacial acetic acid.

This oil consists of a terpene, $C_{10}H_{16}$, and the oxygenated compounds $C_{10}H_{16}O$, $C_{10}H_{18}O$. It is used as an ingredient in soap liniment and compound tincture of lavender.

HEDEOMA. *U.S.* Hedeoma. [PENNYROYAL.]

The leaves and tops of *Hedeoma pulegioides* (Linné) Persoon (nat. ord. *Labiatæ*).

This indigenous plant is frequently confounded with *Mentha pulegium*, or European pennyroyal, which yields an oil having a similar odor and properties. It is stimulant and aromatic.

OLEUM HEDEOMÆ. *U.S.* Oil of Hedeoma. [OIL OF PENNYROYAL.]

A volatile oil distilled from Hedeoma.

It is a colorless or yellowish liquid, of a pungent, mint-like odor and taste and a neutral reaction. Sp. gr. 0.930 to 0.940. It is readily soluble in glacial acetic acid. It should form a perfectly clear solution with twice its volume of a mixture of three volumes of alcohol and one volume of water.

This is an oxygenated oil, and is used principally to protect the exposed parts of the body from the bites of flies, mosquitoes, fleas, etc. It is employed sometimes in amenorrhœa, in doses of one or two minims (0.06 or 0.12 C.c.).

MARRUBIUM. *U. S.* Marrubium. [HOREHOUND.]

The leaves and tops of *Marrubium vulgare* Linné (nat. ord. *Labiatæ*).

This plant contains a volatile oil associated with resin and a bitter principle, *marrubiin.* It is stimulant, tonic, and expectorant.

MELISSA. *U. S.* Melissa. [BALM.]

The leaves and tops of *Melissa officinalis* Linné (nat. ord. *Labiatæ*).

This plant owes its properties of a stimulant and carminative to an oxygenated volatile oil.

OLEUM THYMI. *U. S.* Oil of Thyme.

A volatile oil distilled from the leaves and flowering tops of *Thymus vulgaris* Linné (nat. ord. *Labiatæ*).

It is a colorless or pale yellow, thin liquid, having a strong odor of thyme, a warm, pungent, and afterwards cooling taste, and a neutral reaction. Sp. gr. 0.900 to 0.930. It is soluble in half its volume of alcohol.

The oil, as prepared in the south of France, is known commercially as *oil of origanum.* It is, after one distillation, of a reddish-brown color, and is called the *red oil,* but when again distilled is colorless, and in this condition is distinguished as the *white oil.* The sp. gr. of the red or common oil is stated at 0.905, but probably varies, as the oil is a complex body. The more volatile portion, that coming over below 180° C. (356° F.) in distillation, is a mixture of *cymene,* $C_{10}H_{14}$, boiling at 175° C. (347° F.), and *thymene,* $C_{10}H_{16}$, boiling at 165° C. (329° F.). The less volatile portion is chiefly *thymol,* $C_{10}H_{14}O$, a white, crystalline solid, melting at 44° C. (111.2° F.), and possessing a pungent taste. This substance is also found in oil of monarda (horsemint). (See Thymol.)

Uses.—Oil of origanum, as it is usually called, is largely used in liniments as a stimulant.

THYMOL. *U. S.* Thymol.

$C_{10}H_{14}O = 149.66.$

A phenol occurring in the volatile oils of *Thymus vulgaris* Linné, *Monarda punctata* Linné (nat. ord. *Labiatæ*), and *Carum Ajowan* (Roxburgh) Bentham et Hooker (nat. ord. *Umbelliferæ*).

Preparation.—Thymol is obtained from the volatile oils of several plants by fractional distillation, by which terpenes are separated. The portion distilling above 190° C. (374° F.) is collected, agitated with solution of soda to separate more of the terpenes, and cooled; the compound of thymol with soda is then decomposed by hydrochloric acid. Thymol is recrystallized from an alcoholic solution. It has been obtained from *Monarda didyma* Linn., *M. punctata, Ammi copticum,* and *Ptychotis ajowan.* The phenol of the oil of *Thymus serpyllum* Linn. closely resembles thymol, but differs from it in not congealing at 10° C.

(50° F.), in its solution in diluted alcohol turning green with ferric chloride, and in the potassium salt with its sulpho-acid being amorphous.

Thymol. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Large, colorless, translucent crystals of the hexagonal system. Its sp. gr. as a solid is 1.069 at 15° C. (59° F.); after fusion it is lighter than water. It melts at 50° to 51° C. (122° to 123.8° F.), remaining liquid at lower temperatures. When triturated with about equal quantities of camphor, menthol, or chloral, it liquefies.	Aromatic, thyme-like odor; pungent, aromatic taste, with a very slight caustic effect upon the lips; neutral reaction.	At 15° C. (59° F.), 1200 parts.	At 15° C. (59° F.), Less than its own weight.	Soluble in less than its own weight of ether or chloroform; also readily soluble in carbon disulphide, glacial acetic acid, and fixed or volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
Its alcoholic solution is optically inactive. If a very small crystal of Thymol be dissolved in 1 C.c. of glacial acetic acid, and then 6 drops of sulphuric acid and 1 drop of nitric acid be added, the liquid will assume a deep bluish-green color.	Thymen or Lævogyrate Pinene ($C_{10}H_{16}$).	If 1 Gm. of Thymol be heated in a test-tube, in a water-bath, with 5 C.c. of a 10-per-cent. solution of sodium hydrate, a clear, colorless, or very slightly reddish solution should be formed, which becomes darker on standing, but without the separation of oily drops. If to this solution a few drops of chloroform be added, and the mixture agitated, a violet color will be produced.
	Paraffin, Spermaceti, etc.	When a crystal of Thymol is heated in an open capsule, or in a watch-glass, on a water-bath, it should gradually volatilize, leaving no residue.

Uses.—Thymol is a valuable antiseptic, and may be used for the same purposes as carbolic acid.

SALVIA. *U. S.* Salvia. [Sage.]

The leaves of *Salvia officinalis* Linné (nat. ord. *Labiatæ*).

This useful plant contains a volatile oil, which consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, *salviol*, $C_{10}H_{18}O$. It also contains tannin and extractive. It is used largely as a condiment. Infusion of sage is a popular remedy in sore throat.

SCUTELLARIA. *U. S.* Scutellaria.

[Scullcap.]

The herb of *Scutellaria lateriflora* Linné (nat. ord. *Labiatæ*).

This plant contains volatile oil, tannin, and a bitter principle. It is used as a tonic and antispasmodic.

Official Preparation.

Extractum Scutellariæ Fluidum . Fluid Extract of Scutellaria.	Made with a menstruum of diluted alcohol by percolation (see page 423). Dose, one-half to one fluidrachm (1.9 to 3.7 C.c.).

Unofficial Plants of, and Substances from, the Labiatæ.

Aristol, Dithymoldiiodide, $C_{20}H_{24}O_2I_2$, or $\left.\begin{matrix}C_3H_7\\CH_3\end{matrix}\right\}C_6H_2(OI)$ $\left.\begin{matrix}CH_3\\C_3H_7\end{matrix}\right\}C_6H_2(OI)$.	Anæsthetic, antiseptic.
Brunella.	The herb of *B.* (*Prunella*) *vulgaris*. Found in North America, Asia, and Europe.
Calamintha. Wild Basil.	The herb of *C. clinopodium*.
Cataria, Catnep.	Antispasmodic and emmenagogue. Dose, two drachms (7.77 Gm.) in infusion.
Collinsonia, Horsebalm.	The herb of *Collinsonia canadensis*, grown in North America.
Glechoma, Ground-Ivy.	From *G. hederacea* and others, grown in Europe. It contains volatile oil, resin, etc.
Hyssopus, Hyssop.	From *H. officinalis*, indigenous to Southern Europe. It contains about ½ per cent. of volatile oil, etc.
Lavender.	The flowers of *Lavandula vera*. It was formerly official, and contains a volatile oil.
Leonurus, Motherwort.	The herb of *L. cardiaca*, grown in Europe. It contains volatile oil and a bitter principle.
Lycopus, Bugleweed.	The herb of *L. virginicus*, found in the United States. It contains a volatile oil, resin, etc.
Monarda. Horsemint.	The leaves and tops of *M. punctata*, indigenous to the United States. It contains a volatile oil, etc.
Rosemary.	The leaves of *Rosmarinus officinalis*. It was formerly official, and contains a volatile oil.

Official Products of the Aromatic Umbelliferæ.

The aromatic plants belonging to the natural order Umbelliferæ are all characterized by the very distinctive properties of the volatile oils obtained by distilling their fruits (sometimes called seeds) with water. These oils are oxygenated, and are soluble in alcohol. Cumin and dill belong to this class: they are not official.

CARUM. *U. S.* Caraway.

The fruit of *Carum Carvi* Linné (nat. ord. *Umbelliferæ*).

This fruit, commonly called caraway seed, contains about 5 per cent. of volatile oil, with a little fixed oil and other constituents. It is carminative and stimulant.

OLEUM CARI. *U. S.* Oil of Caraway.

A volatile oil distilled from Caraway.

It is a pale yellow liquid, having the odor of caraway, and a sp. gr. of 0.910 to 0.920. It is soluble in an equal weight of alcohol. It consists of a terpene, *carvene*, $C_{10}H_{16}$, and *carvol*, $C_{10}H_{14}$. It is a useful aromatic oil.

FŒNICULUM. *U. S.* Fennel.

The fruit of *Fœniculum capillaceum* Gilibert (nat. ord. *Umbelliferæ*).

This fruit contains about 5 per cent. of an oxygenated volatile oil, with 10 per cent. of fixed oil. It is used in compound infusion of senna.

OLEUM FŒNICULI. *U. S.* Oil of Fennel.

A volatile oil distilled from Fennel. It should be kept in well-stoppered bottles, in a cool place, and, if it has partly or wholly solidified, it should be completely liquefied by warming before being dispensed.

This is a pale yellow liquid, having the odor of fennel, and a sp. gr. of not less than 0.960. It sometimes congeals when cooled to 5° C.

(41° F.). It consists of a terpene, $C_{10}H_{16}$, and *anethol*, $C_{10}H_{12}O$. It is used in compound powder of glycyrrhiza.

Official Preparation.

Aqua Fœniculi. Fennel Water. Made by adding 2 C.c. of oil of fennel to 4 Gm. of precipitated calcium phosphate, and filtering it with 1000 C.c. of distilled water (see page 290).

CORIANDRUM. *U. S.* Coriander.

The fruit of *Coriandrum sativum* Linné (nat. ord. *Umbelliferæ*).

This fruit furnishes an agreeable aromatic oil. The yield is about 1 per cent. It also contains about 10 per cent. of fixed oil.

OLEUM CORIANDRI. *U. S.* Oil of Coriander.

A volatile oil distilled from Coriander.

It is a colorless or yellowish liquid, having the characteristic aromatic odor of coriander, a warm, spicy taste, and a neutral reaction. Sp. gr. 0.870 to 0.885. It is readily soluble in alcohol. 1 C.c. of the oil forms a perfectly clear solution with 3 C.c. of a mixture of three volumes of alcohol and one volume of water.

This oil is composed principally of $C_{10}H_{18}O$. It is officially used in confection of senna and syrup of senna.

SUMBUL. *U. S.* Sumbul.

The root of *Ferula Sumbul* (Kauffmann) Hooker filius (nat. ord. *Umbelliferæ*).

This Asiatic root contains about ½ per cent. of volatile oil and about 10 per cent. of a resinous compound having a musky odor. It is used as a stimulant and nervine.

Official Preparation.

Tinctura Sumbul . . . Tincture of Sumbul. Made by percolating 100 Gm. of sumbul with a menstruum composed of 650 C.c. of alcohol to 350 C.c. of water until 1000 C.c. are obtained (see page 379). Dose, one-half to one fluidrachm (1.9 to 3.7 C.c.).

ANISUM. *U. S.* Anise.

The fruit of *Pimpinella Anisum* Linné (nat. ord. *Umbelliferæ*).

This fruit contains about 2 per cent. of volatile oil and 3 per cent. of fixed oil. It is a useful carminative and stimulant.

OLEUM ANISI. *U. S.* Oil of Anise.

A volatile oil distilled from Anise. It should be kept in well-stoppered bottles protected from light, and, if it has separated into a liquid and a solid portion, it should be completely liquefied by warming before being dispensed.

This oil is colorless or yellowish, with the peculiar odor and taste of the fruit. Its sp. gr. is about 0.980 to 0.990, increasing with age. At 10° to 15° C. (50° to 59° F.) it solidifies to a crystalline mass, which does not resume its fluidity until the temperature rises to about 17° C. (62.6° F.). The oil is soluble in nearly an equal weight of alcohol. *Oil of Illicium* (*Star Anise*) has the same properties, except that it congeals at about 2° C. (35.6° F.). It consists of a small quantity of a

hydrocarbon, $C_{10}H_{16}$, but mainly of anethol, $C_{10}H_{12}O$, which is present in two modifications, one solid at ordinary temperatures and heavier than water (*anise camphor, solid anethol*), the other liquid and more volatile (*liquid anethol*). *Anethol*, both in the liquid and in the solid form, is present, and is the chief constituent of the oils of *anise, star-aniseed*, and *fennel.*

Official Preparations.

Aqua Anisi . . . . . . Anise Water.	Made by adding 2 C.c. of oil of anise to 4 Gm. of precipitated calcium phosphate and filtering with distilled water until 1000 C.c. are obtained (see page 287).
Spiritus Anisi . . . . Spirit of Anise.	Made by mixing 100 C.c. of oil of anise with 900 C.c. of deodorized alcohol (see page 329). Dose, thirty minims to one fluidrachm (1.9 to 3.7 C.c.).

ILLICIUM. *U. S.* Illicium. [STAR-ANISE.]

The fruit of *Illicium verum* Hooker filius (nat. ord. *Magnoliaceæ*).

This fruit does not belong to the Umbelliferæ, but, as it is the source of nearly all the commercial oil of anise, it must be considered here. Star-anise contains about 5 per cent. of volatile oil, nearly identical with the oil from Pimpinella Anisum (see Oleum Anisi): it also contains resin and fixed oil.

Unofficial Volatile Oils and Plants of the Umbelliferæ.

Anethum Graveolens. Dill.	An umbelliferous fruit, indigenous to Southern Europe.
Oleum Anethi. Oil of Dill.	An oxygenated oil: the yield is about 4 per cent.
Angelica. Angelica-root.	The root of several species of *Angelica*, grown in Europe and America.
Oleum Angelicæ. Oil of Angelica.	A yellowish, volatile oil: the yield is about ½ per cent.
Carota. Carrot Fruit.	The fruit of *Daucus Carota*, indigenous to Northern Asia.
Oil of Carrot.	An oxygenated oil.
Cicuta. Water-Hemlock.	The herb of *Cicuta virosa*, found in Northern Canada.
Cuminum. Cumin.	The fruit of *Cuminum Cyminum*, indigenous to Egypt.
Oil of Cumin.	Consists of several hydrocarbons: the yield is about ½ per cent.
Heracleum. Cow-Parsnip (Masterwort).	From *Heracleum lanatum*, grown in the United States. It contains a volatile oil, resin, etc.
Levisticum. Lovage.	The root of *Levisticum officinale*, indigenous to Southern Europe. It contains soft and pungent resins.
Petroselinum. Parsley.	The root of *P. sativum*, indigenous to Europe. It contains a volatile oil and apiin, $C_{24}H_{28}O_{13}$.
Oil of Parsley.	A colorless or yellowish, volatile oil, sp. gr. 1.01–1.14: the yield is about 1½ per cent.
Phellandrium. Water-Fennel.	The fruit of *Œnanthe Phellandrium*, grown in Europe. It contains about 1½ per cent. of volatile oil and resins.

Official Aromatic Products, with their Volatile Oils.

CINNAMOMUM CASSIA. *U. S.* Cassia Cinnamon.

[CINNAMOMUM, PHARM. 1880. CASSIA BARK.]

The bark of the shoots of one or more undetermined species of *Cinnamomum* grown in China (Chinese Cinnamon) (nat ord. *Laurineæ*).

CINNAMOMUM SAIGONICUM. *U. S.* Saigon Cinnamon.

The bark of an undetermined species of *Cinnamomum* (nat. ord. *Laurineæ*).

CINNAMOMUM ZEYLANICUM. *U. S.* Ceylon Cinnamon.

[CINNAMOMUM, PHARM. 1880.]

The inner bark of the shoots of *Cinnamomum zeylanicum* Breyne (nat. ord. *Laurineæ*).

Ceylon, Saigon, and Chinese cinnamon, or *cassia*, all owe their virtues to a volatile oil: there are also present tannin, mannite, mucilage, sugar, etc. The tannin present often causes fluid extract of cinnamon to gelatinize through its alteration. Nine official preparations contain cinnamon; in one it is the sole active ingredient.

Official Preparation.

Tinctura Cinnamomi . Made by percolating 100 Gm. of powdered Ceylon cinnamon with Tincture of Cinnamon. sufficient menstruum, composed of 750 C.c. of alcohol, 200 C.c. of water, and 50 C.c. of glycerin, to obtain 1000 C.c. (see page 365). Dose, one to two fluidrachms (1.9 to 3.7 C.c.).

OLEUM CINNAMOMI. *U. S.* Oil of Cinnamon.

[OIL OF CASSIA.]

A volatile oil distilled from Cassia Cinnamon.

There are two oils of cinnamon in commerce: one procured from the Ceylon cinnamon, the other from the Chinese cinnamon: the latter (*oil of cassia*) is now the only official one. There is no essential difference in the two oils; and that of the Chinese cinnamon, as much the cheaper and more abundant of the two, will probably continue to be generally employed, notwithstanding that the Ceylon product has the finer flavor. The quality of oil of cinnamon has been greatly improved through the publication by Schimmel & Co. of good tests for detecting adulterations.

Oleum Cinnamomi. U. S.	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvent.
A yellowish or brownish liquid, becoming darker and thicker by age and exposure to the air. Specific gravity, 1.055 to 1.065 at 15° C. (59° F.).	Characteristic odor of cinnamon; sweetish, spicy, and burning taste.	In an equal volume.	In an equal volume of glacial acetic acid.

Tests for Identity.	Impurities.	Tests for Impurities.
When shaken with a saturated solution of sodium bisulphite, it solidifies to a crystalline mass. If 4 drops of the Oil, contained in a test-tube, be cooled to 0° C. (32° F.), and then shaken with 4 drops of fuming nitric acid, crystalline needles or plates will be formed.	Oil of Cloves.	If a portion of the Oil be shaken with water, and the liquid passed through a wet filter, the clear filtrate should give, with a few drops of basic lead acetate T.S., a white turbidity, without a yellow color.
	Oil of Cloves or of Carbolic Acid.	If 4 drops of the Oil be dissolved in 10 C.c. of alcohol, the subsequent addition of a drop of ferric chloride T.S. should produce a brown, but not a green or blue, color.
	Petroleum or Colophony.	If 1 C.c. of the Oil be mixed with 3 C.c. of a mixture of 3 volumes of alcohol and 1 volume of water, a clear solution should result; and if to this solution there be gradually added 2 C.c. of a saturated solution of lead acetate in a mixture of 3 volumes of alcohol and 1 volume of water, no precipitate should be produced.

Oil of Ceylon Cinnamon has a slightly acid reaction. Sp. gr. about 1.040. It is readily soluble in alcohol. When cooled to —10° C. (14° F.) it remains clear, but at a lower temperature a solid portion separates from it. *Oil of Chinese Cinnamon* (Oil of Cassia) has the same properties, except that its sp. gr. is about 1.060 and its odor and taste are not quite so agreeable.

With the exception of quite small quantities of hydrocarbons, oil of cinnamon consists of *cinnamic aldehyde*, C_9H_8O, which by moderate oxidation yields the corresponding cinnamic acid, $C_9H_8O_2$, but by more energetic oxidation yields benzoic acid, $C_7H_6O_2$.

Oil of Ceylon cinnamon when not very fresh contains cinnamic acid in sufficient quantity to give a permanent cloudiness to cinnamon water made from it.

Official Preparations.

Aqua Cinnamomi . . Made by adding 2 C.c. of oil of cinnamon to 4 Gm. of precipitated
Cinnamon Water. calcium phosphate, and filtering with distilled water until 1000 C.c. are obtained (see page 289).

Spiritus Cinnamomi . Made by mixing 10 parts of oil of cinnamon with 90 parts of alcohol
Spirit of Cinnamon. (see page 330). Dose, ten to twenty minims (0.6 to 1.2 C.c.).

CARYOPHYLLUS. *U. S.* Cloves.

The unexpanded flowers of *Eugenia aromatica* (Linné) O. Kuntze (nat. ord. *Myrtaceæ*).

Cloves contain about 16 per cent. of volatile oil, 10 per cent. of tannin, *caryophyllin*, $C_{10}H_{16}O$, a crystalline principle, and *eugenin*, $C_{10}H_{12}O_2$, also crystalline. It is used as an aromatic in three official preparations.

OLEUM CARYOPHYLLI. *U. S.* Oil of Cloves.

A volatile oil distilled from Cloves.

Oil of cloves, when recently distilled, is very fluid, clear, and colorless, but becomes yellowish by exposure, and ultimately reddish-brown. The oil of cloves consists of two distinct oils, one lighter (a terpene) and the other heavier than water. They may be separated by distilling the oil from a solution of potassa. The lighter comes over, the heavier remains combined with the potassa, from which it may be separated by adding sulphuric acid and again distilling. *Light oil of cloves* is colorless, is of the sp. gr. 0.918, and has the formula $C_{10}H_{16}$. It is said not to possess active properties. *Heavy oil of cloves* is colorless at first, but darkens with age, has the odor and taste of cloves, is of the sp. gr. 1.079, boils at 243.3° C. (470° F.), and forms soluble and crystallizable salts with the alkalies. It consists of a phenol-like compound, *eugenol* (eugenic acid), $C_{10}H_{12}O_2$, which has been found capable of conversion into *vanillin*.

Oleum Caryophylli. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvent.
A pale yellow, thin liquid, becoming darker and thicker by age and exposure to the air. Specific gravity 1.060 to 1.067 at 15° C. (59° F.).	Strongly aromatic odor of cloves; pungent and spicy taste; slightly acid reaction.	Soluble in an equal volume.	Soluble in an equal volume of glacial acetic acid.

Tests for Identity.	Impurities.	Tests for Impurities.
When shaken with an equal volume of a concentrated solution of potassium hydrate, or of stronger ammonia water, it forms a semi-solid, yellowish mass. If 2 drops of the Oil be dissolved in 4 C.c. of alcohol, and a drop of ferric chloride T.S. added, a bright green color will be produced; and if the same test be made with a drop of dilute ferric chloride T.S., prepared by diluting the test-solution with four times its volume of water, a blue color will be produced, which soon changes to yellow.	Petroleum, most Fatty Oils, Oil of Turpentine, and Similar Oils.	If 1 C.c. of the Oil be mixed with 2 C.c. of a mixture of 2 volumes of alcohol and 1 volume of water, it should form a clear and perfect solution.
	Phenol or Carbolic Acid.	If, after cooling, the aqueous layer be passed through a wet filter, the clear filtrate should yield, with a drop of ferric chloride T.S., only a transient grayish-green, but not a violet or blue color.

Oil of cloves is largely used as a remedy for toothache. It produces relief if the pain is caused by an exposed nerve, and may be used by applying a little upon cotton to the affected nerve.

PIMENTA. *U. S.* Pimenta. [Allspice.]

The nearly ripe fruit of *Pimenta officinalis* Lindley (nat. ord. *Myrtaceæ*).

This aromatic fruit contains about 3 per cent. of volatile oil, with tannin, fat, resin, gum, sugar, etc.

OLEUM PIMENTÆ. *U. S.* Oil of Pimenta. [Oil of Allspice.]

A volatile oil distilled from Pimenta.

It is a colorless or pale yellow liquid, becoming darker and thicker by age and exposure to air, having a strong, aromatic, clove-like odor, a pungent, spicy taste, and a slightly acid reaction. Sp. gr. 1.045 to 1.055. It is readily soluble in alcohol. With an equal volume of a concentrated solution of sodium hydrate it forms a semi-solid mass.

It contains a terpene, $C_{10}H_{16}$, and *eugenol*, $C_{10}H_{12}O_2$. It is used as an ingredient in spirit of myrcia.

OLEUM MYRCIÆ. *U. S.* Oil of Myrcia. [Oil of Bay.]

A volatile oil distilled from the leaves of *Myrcia acris* De Candolle (nat. ord. *Myrtaceæ*).

This oil is used almost exclusively in making artificial bay rum: it is very apt to be adulterated. Sp. gr. 0.975 to 0.990.

Oleum Myrciæ. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A yellow or brownish-yellow liquid. When mixed with an equal volume of a concentrated solution of sodium hydrate, it forms a semi-solid mass.	Aromatic, somewhat clove-like odor; pungent spicy taste; scarcely perceptible acid reaction.	With an equal volume it yields slightly turbid solutions.	With equal volumes of glacial acetic acid or carbon disulphide it yields slightly turbid solutions.

Tests for Identity.	Impurity.	Tests for Impurity.
If 2 drops of the Oil be dissolved in 4 C.c. of alcohol and a drop of ferric chloride T.S. be added, a light green color will be produced; and if the same test be made with a drop of diluted ferric chloride T.S., prepared by diluting the test-solution with four times its volume of water, a light bluish coloration will be produced, which soon disappears.	Carbolic Acid.	If 1 C.c. be shaken with 20 C.c. of hot water, the water should not give more than a scarcely perceptible acid reaction. If, after cooling, the liquid be passed through a wet filter, the clear filtrate should produce, with a drop of ferric chloride T.S., only a transient grayish-green, but not a blue or violet color.

If to 3 drops of the Oil, contained in a small test-tube, 3 drops of concentrated sulphuric acid be added, and, after the tube has been corked, the mixture be allowed to stand for half an hour, a resinous mass will be obtained. On adding to this mass 4 C.c. of diluted alcohol, vigorously shaking the mixture, and gradually heating to the boiling point, the liquid should remain nearly colorless, and should not acquire a red or purplish-red color (distinction from *oil of pimenta* and *oil of cloves*).

This oil, like the oil of cloves and the oil of pimenta, consists of two portions, a terpene, $C_{10}H_{16}$, and *eugenol*, $C_{10}H_{12}O_2$.

Official Preparation.

Spiritus Myrciæ . . . . Spirit of Myrcia (Bay Rum). — Made by mixing 16 C.c. of oil of myrcia, 1 C.c. of oil of pimenta, and 1 C.c. of oil of orange peel, with alcohol and water to make 2000 C.c. (see page 333). Used externally.

VANILLA. *U.S.* Vanilla.

The fruit of *Vanilla planifolia* Andrews (nat. ord. *Orchideæ*).

This valuable drug contains a trace of a volatile oil, 10 per cent. of fixed oil, resin, sugar, etc., and *vanillin*, $C_8H_8O_3$. This is the aldehyde of methyl-protocatechuic acid, and is now largely prepared from eugenol, coniferin, phenol, and benzoin.

Artificial vanillin has been used as a substitute for vanilla in flavoring; but, owing to the presence of the odorous oil in "vanilla bean," it is not identical.

Official Preparation.

Tinctura Vanillæ . . . Tincture of Vanilla. — Made by macerating 100 Gm. of vanilla with 500 C.c. of a mixture of 65 parts of alcohol and 35 parts of water, draining and reserving the macerate, beating the residue with 200 Gm. of sugar, and percolating with the reserved liquid and sufficient menstruum to make 1000 C.c. (see page 380).

OLEUM CAJUPUTI. *U.S.* Oil of Cajuput.

A volatile oil distilled from the leaves of *Melaleuca Leucadendron* Linné (nat. ord. *Myrtaceæ*).

This aromatic oil is very fluid, transparent, of a green color, a penetrating odor, analogous to that of cardamom, and a warm, pungent taste. Its composition is $C_{10}H_{16}H_2O$. It is termed chemically *cajuputene hydrate*, or *cajuputol*. It boils at 175° C. (347° F.), and is freely soluble in alcohol. Sp. gr. 0.922 to 0.929. On shaking 5 C.c. of the Oil with 5 C.c. of water containing a drop of diluted hydrochloric acid, the Oil loses its green tint and becomes nearly colorless. If to this acid liquid, separated from the Oil, a drop of potassium ferrocyanide T.S. be added, a reddish-brown color will usually be produced

(presence of traces of *copper*). If 5 parts of the Oil be heated to 50° C. (122° F.), and 1 part of powdered iodine gradually added, with avoidance of any further rise of temperature, the mixture, on cooling, will deposit a mass of crystals. When it is distilled, a light, colorless liquid first comes over, and afterwards a green and denser one. The green color has been ascribed to a salt of copper derived from the vessels in which the distillation is performed; and various investigators have found traces of copper present in it. Others, again, have carefully tested the green oil and proved its absence. A fair inference is that the oil of cajuput is naturally green, but that as found in commerce it sometimes contains copper, either accidentally present, or added with a view of imitating or maintaining the fine color of the oil.

EUCALYPTUS. *U. S.* Eucalyptus.

The leaves of *Eucalyptus globulus* Labillardière (nat. ord. *Myrtaceæ*), collected from the older parts of the tree.

The virtues of eucalyptus leaves depend upon a volatile oil: there are also present resin, tannin, chlorophyll, fatty acid, etc. The leaves are used as a stimulant, febrifuge, or astringent.

Official Preparation.

Extractum Eucalypti Fluidum. Fluid Extract of Eucalyptus. Made by percolating Eucalyptus with 3 parts of alcohol and 1 part of water (see page 405). Dose, ten to forty minims (0.6 to 2.4 C.c.).

OLEUM EUCALYPTI. *U. S.* Oil of Eucalyptus.

A volatile oil distilled from the fresh leaves of *Eucalyptus globulus* Labillardière, *Eucalyptus oleosa* F. v. Mueller, and some other species of *Eucalyptus* (nat. ord. *Myrtaceæ*).

It is a colorless or very pale yellowish liquid, having a characteristic aromatic odor, a pungent, spicy, and cooling taste, and a neutral reaction. Sp. gr. 0.915 to 0.925. It is soluble in all proportions of alcohol, carbon disulphide, and glacial acetic acid. If 1 C.c. of the Oil be mixed with 2 C.c. of glacial acetic acid, and 1 or 2 C.c. of a saturated, aqueous solution of sodium nitrite be gradually added, the mixture, when gently stirred, should not form a crystalline mass (distinction from *oils of Eucalyptus containing a considerable proportion of phellandrene*).

The larger portion of the oil consists of *eucalyptol*, $C_{10}H_{16}O$, which is very soluble in alcohol; there are also present two terpenes, $C_{10}H_{14}$, $C_{10}H_{16}$.

EUCALYPTOL. *U. S.* Eucalyptol.

$C_{10}H_{18}O = 153.66.$

A neutral body obtained from the volatile oil of *Eucalyptus globulus* Labillardière, and of some other species of *Eucalyptus* (nat. ord. *Myrtaceæ*).

Eucalyptol. *U. S.*	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvents.
A colorless liquid. Specific gravity, 0.930 at 15° C. (59° F.). Boiling point, 176° to 177° C. (348.8° to 350.6° F.). It is optically inactive (distinction from the *oil of Eucalyptus* and *many other volatile oils*).	Characteristic aromatic and distinctly camphoraceous odor; pungent, spicy, and cooling taste.	In all proportions.	In all proportions in carbon disulphide and glacial acetic acid.

Tests for Identity.	Impurities.	Tests for Impurities.
When exposed to a temperature some degrees below 0° C. (32° F.), or placed in a freezing mixture, it solidifies to a mass of colorless, needle-shaped crystals, which liquefy at —1° C. (30.2° F.). If a portion of Eucalyptol be shaken with an equal volume of sodium hydrate T.S., it should not diminish in volume.	Phenols.	Its alcoholic solution should be neutral to litmus-paper, and should not assume a brownish or violet color on the addition of a drop of ferric chloride T.S.

MYRISTICA. *U. S.* Nutmeg.

The seed of *Myristica fragrans* Houttuyn (nat. ord. *Myristicaceæ*), deprived of its testa.

This valuable spice owes its activity to the presence of an oxygenated volatile oil. Nutmeg contains about 25 per cent. of fixed oil, together with proteids, starch, etc. It forms one of the ingredients in at least seven official preparations.

OLEUM MYRISTICÆ. *U. S.* Oil of Nutmeg.

A volatile oil distilled from Nutmeg.

It is a colorless or pale yellowish liquid, having the characteristic odor of nutmeg, a hot, spicy taste, and a neutral reaction. Sp. gr. 0.870 to 0.900. It is readily soluble in alcohol.

This oil consists of a terpene called *myristicene*, $C_{10}H_{16}$, and an oxygenated portion, $C_{10}H_{14}O$, *myristicol.* It is used in aromatic spirit of ammonia.

Expressed oil of nutmeg, or *oil of mace*, is made by expressing nutmegs between hot plates, or macerating them in carbon disulphide, and distilling the macerate. It is a fat, having the composition $C_3H_5(C_{14}H_{27}O_2)_3$, *myristicin.*

Official Preparation.

Spiritus Myristicæ . Made by mixing 50 C.c. of oil of nutmeg with 950 C.c. of alcohol (see Spirit of Nutmeg. page 333).

MACIS. *U. S.* Mace.

The arillode of the seed of *Myristica fragrans* Houttuyn (nat. ord. *Myristicaceæ*).

This aromatic contains about 10 per cent. of a light, volatile oil, chiefly a terpene, $C_{10}H_{16}$ *(macene).* A fixed oil is obtained from mace: it is not a solid, and is not identical with the expressed oil of nutmeg, erroneously called *oil of mace.*

CASCARILLA. *U. S.* Cascarilla.

The bark of *Croton Eluteria* Bennett (nat. ord. *Euphorbiaceæ*).

Cascarilla contains about 2 per cent. of an oxygenated volatile oil, a crystalline principle, *cascarillin*, $C_{12}H_{18}O_4$, 15 per cent. of resin, also tannin, gum, pectin, etc. It is used as a stimulant and tonic. Dose, twenty grains (1.3 Gm.).

SASSAFRAS. *U. S.* Sassafras.

The bark of the root of *Sassafras variifolium* (Salisbury) O. Kuntze (nat. ord. *Laurineæ*).

This well-known bark contains volatile oil, sassafrid, tannin, starch,

resin, etc. It is principally used on account of its aromatic oil. It enters into two official preparations of sarsaparilla.

OLEUM SASSAFRAS. *U. S.* Oil of Sassafras.

A volatile oil distilled from Sassafras.

It is a colorless or yellowish liquid, becoming darker and somewhat thicker by age and exposure to air, having the characteristic odor of sassafras, a warm, aromatic taste, and a neutral reaction. Sp. gr. 1.070 to 1.090. It is readily soluble in alcohol. When treated with cold nitric acid, it becomes dark red, and is finally converted into a red resin. If to a few drops of the oil a drop of sulphuric acid be added, a deep red color will be produced at first, which soon becomes blackish.

This oil is largely produced in New Jersey and Maryland from the wood and bark of the sassafras: the yield is about 2 per cent. It consists of a terpene, $C_{10}H_{16}$ (*safrene*), and an oxygenated portion, $C_{10}H_{10}O_2$ (*safrol*), now also obtained on an immense scale from oil of camphor.

OLEUM GAULTHERIÆ. *U. S.* Oil of Gaultheria.

[OIL OF WINTERGREEN.]

A volatile oil distilled from the leaves of *Gaultheria procumbens* Linné (Wintergreen; nat. ord. *Ericaceæ*), consisting almost entirely of Methyl Salicylate [$CH_3C_7H_5O_3$ = 151.64], and nearly identical with Volatile Oil of Betula.

This oil consists of a terpene, $C_{10}H_{16}$, termed *gaultherilene*, and methyl salicylate, $CH_3,C_7H_5O_3$. It is the heaviest of all the volatile oils, having the sp. gr. 1.175 to 1.185. When mixed with concentrated solution of soda or potassa it becomes a solid crystalline mass, and the odor of the oil is lost. It is a colorless or yellow or reddish liquid, of a peculiar, strong, and aromatic odor, a sweetish, warm, and aromatic taste, and a slightly acid reaction. It is readily soluble in alcohol. The reddish color is due to a trace of iron. Boiling point, 218° to 221° C. (424.4° to 429.2° F.). It deviates polarized light slightly to the left: in other respects it has the same properties and conforms to the same reactions and tests as methyl salicylate (see Methyl Salicylas and Oleum Betulæ Volatile).

The adulteration with chloroform or alcohol is shown by heating it to about 80° C. (176° F.), when the oil should not yield a colorless distillate having the characteristics of chloroform or of alcohol; and that of oil of sassafras by mixing 5 drops of the oil with 5 drops of nitric acid, when the mixture should not acquire a deep red color and should not solidify to a dark red, resinous mass.

Uses.—Oil of gaultheria is used in place of salicylic acid in neuralgia and kindred diseases, in doses of ten to twenty minims (0.6 to 1.2 C.c.).

Official Preparation.

Spiritus Gaultheriæ . Made by mixing 50 C.c. of oil of gaultheria with 950 C.c. of alcohol
Spirit of Gaultheria. (see page 331). Dose, ten to twenty minims (0.6 to 1.2 C.c.).

OLEUM BETULÆ VOLATILE. *U. S.* Volatile Oil of Betula.

[OIL OF SWEET BIRCH.]

A volatile oil obtained by distillation from the bark of *Betula lenta* Linné (Sweet Birch; nat. ord. *Betulaceæ*). It is identical with Methyl Salicylate [$CH_3C_7H_5O_3$], and nearly identical with Oil of Gaultheria.

METHYL SALICYLAS. *U. S.* **Methyl Salicylate.**

$CH_3C_7H_5O_3 = 151.64.$

[ARTIFICIAL (OR SYNTHETIC) OIL OF WINTERGREEN.]

This may be made by distilling salicylic acid or a salicylate with methyl alcohol and strong sulphuric acid.

Methyl Salicylas. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A colorless or slightly yellowish liquid. Is identical with the essential constituent of oil of gaultheria. Is wholly identical with the volatile oil of betula. Sp. gr. 1.183–1.185 at 15° C. (59° F.). Boiling point, 219°–221° C. (426.2°–429.8° F.). It is optically inactive.	It has the strongly aromatic odor and sweetish, warm, and aromatic taste of oil of gaultheria; neutral or slightly acid reaction.	In all proportions in alcohol, glacial acetic acid, or carbon disulphide.

Tests for Identity.	Impurities.	Tests for Impurities.
If a drop of Methyl Salicylate be shaken with a little water, and a drop of ferric chloride T.S. subsequently added, a deep violet color will be produced. When heated on a water-bath, in a flask provided with a suitable condenser, it should yield no distillate having the characteristics of alcohol or chloroform.	Other Volatile Oils or Petroleum.	If to 1 C.c. of Methyl Salicylate, contained in a capacious test-tube, 10 C.c. of sodium hydrate T.S. be added, and the mixture agitated, a bulky, white crystalline precipitate will be produced; then, if the test-tube, loosely corked, be allowed to stand in boiling water for about five minutes, with occasional agitation, the precipitate should dissolve, and form a clear, colorless, or faintly yellowish solution, without the separation of any oily drops, either on the surface or at the bottom of the liquid.
	Methyl Benzoate, etc.	If the alkaline liquid thus obtained be subsequently diluted with about three times its volume of water, and a slight excess of hydrochloric acid added, a white, crystalline precipitate will be produced, which, when collected on a filter, washed with a little water, and recrystallized from hot water, should respond to the tests of identity and purity described under *Acidum Salicylicum*.

Uses.—Methyl salicylate is asserted to be identical in medical properties with oil of wintergreen and oil of sweet birch.

CALAMUS. *U. S.* **Calamus.** [SWEET FLAG.]

The rhizome of *Acorus Calamus* Linné (nat. ord. *Aroideæ*).

Calamus contains a volatile oil having the composition of a terpene, $C_{10}H_{16}$, soft resin, a bitter principle, acorin, starch, and mucilage. It is esteemed solely on account of its aromatic properties, which are due to the volatile oil.

Official Preparation.

Extractum Calami Fluidum . Made with a menstruum of alcohol (see page 397). Dose, Fluid Extract of Calamus. one-half to one fluidrachm (1.8 to 3.7 C.c.).

CARDAMOMUM. *U. S.* **Cardamom.**

The fruit of *Elettaria repens* (Sonnerat) Baillon (nat. ord. *Scitamineæ*).

This valuable aromatic is imported from India. The seeds contain 5 per cent. of an oxygenated volatile oil, of the sp. gr. 0.943, 10 per cent.

of fixed oil, starch, mucilage, etc. Owing to the presence of the fixed oil, they are very difficult to powder alone: hence the practice in compound powders containing cardamom of mixing the other ingredients with it, so that they may absorb the oil. The oil of cardamom is usually made by percolation with ether, and is a mixture of both volatile and fixed oils. Cardamom enters into a number of official preparations, in two of which it is the principal ingredient.

Official Preparations.

Tinctura Cardamomi . . . . . . Tincture of Cardamom.	Made by percolating 100 Gm. of cardamom with sufficient diluted alcohol to make 1000 C.c. (see page 363). Dose, one fluidrachm (3.7 C.c.).
Tinctura Cardamomi Composita . Compound Tincture of Cardamom.	Made by percolating 20 Gm. each of cardamom and cinnamon, 10 Gm. of caraway, and 5 Gm. of cochineal with sufficient diluted alcohol to obtain 950 C.c., and adding 50 C.c. of glycerin to the percolate (see page 364). Dose, one fluidrachm (3.7 C.c.).

ZINGIBER. *U.S.* Ginger.

The rhizome of *Zingiber officinale* Roscoe (nat. ord. *Scitamineæ*).

This well-known and largely used rhizome owes its virtues to about 4 per cent. of volatile oil, having the composition $C_{10}H_{16}$, and therefore a terpene, and a soft, pungent, aromatic resin, which is soluble in alcohol and ether. It is used in a number of official preparations, in three of which it is the sole medicinal ingredient.

Official Preparations.

Extractum Zingiberis Fluidum . Fluid Extract of Ginger.	Made with a menstruum of alcohol (see page 429). Dose, ten to thirty minims (0.6 to 1.8 C.c.).
Oleoresina Zingiberis . . . . . Oleoresin of Ginger.	Made by percolating powdered ginger with ether (see page 435). The yield is 6 to 8 per cent. Dose, one minim (0.06 C.c.).
Syrupus Zingiberis . . . . . . Syrup of Ginger.	Made from 30 C.c. fluid extract of ginger, 850 Gm. sugar, and sufficient water to make 1000 C.c. (see page 312).
Tinctura Zingiberis . . . . . . Tincture of Ginger.	Made by percolating 200 Gm. powdered ginger with sufficient alcohol to make 1000 C.c. (see page 380). Dose, one fluidrachm (3.7 C.c.).
Trochisci Zingiberis . . . . . . Troches of Ginger.	Each troche contains 2 grains of tincture of ginger (see Trochisci).

Unofficial Terpenes.

Oil of Burgundy Pitch.	From *Abies excelsa*. Nat Ord. Coniferæ. Habitat, Europe.
Calamus.	From the rhizome of *Acorus Calamus*. Nat. Ord. Araceæ. Habitat, North America. The yield is about 1½ to 2 per cent.
Canada Turpentine.	From the oleoresin of *Abies balsamea*. Nat. Ord. Coniferæ.
Cedrat.	From *Citrus medica*. Nat Ord. Aurantiaceæ. Used in perfumery.
Elemi.	From *Canarium commune*. Nat. Ord. Burseraceæ. Habitat, Philippine Islands. The yield is about 10 per cent.
Gurjun Balsam.	From *Dipterocarpus turbinatus*. Nat. Ord. Dipterocarpaceæ. Habitat, India. The yield is about from 40 to 70 per cent.
Hemlock Spruce.	From *Abies canadensis*. Nat. Ord. Coniferæ. Habitat, Canada.
Hungarian Turpentine.	From *Pinus Pumilio*. Nat. Ord. Coniferæ.
Jaborandi.	From the leaflets of *Pilocarpus pennatifolius*. Nat. Ord. Rutaceæ. Habitat, Brazil.
Myrtle.	From *Myrtus communis*. Nat. Ord. Myrtaceæ.
Sage.	From the leaves of *Salvia officinalis*. Nat. Ord. Labiatæ. The yield is about ½ per cent.
Strassburg Turpentine.	From *Abies pectinata*. Nat. Ord. Coniferæ.
Templin.	From the shoots of *Pinus Pumilio*. It is a colorless or yellowish-green oil, of an agreeable, somewhat terebinthinate odor.
Venice Turpentine.	From *Larix europæa*. Nat. Ord. Coniferæ.

Unofficial Oxygenated Oils.

Oil of Absinthium.	From *Artemisia Absinthium.* Nat. Ord. Compositæ.
Angustura.	From the bark of *Galipea Cusparia.* Nat. Ord. Rutaceæ. Habitat, South America. Yield about ¼ per cent. Composition, $C_{13}H_{24}O$.
Anthemis.	From the flower-heads of *Anthemis nobilis.* Nat. Ord. Compositæ. Habitat, Europe.
Arnica.	From the root and flowers of *Arnica montana.* Nat. Ord. Compositæ. Habitat, Europe. Yield about ½ to 1 per cent.
Asarum.	From the rhizome of *Asarum canadense.* It is used to give permanence to the odors of cologne waters.
Buchu.	From the leaves of *Barosma betulina, B. crenulata,* and *B. serratifolia.* Nat. Ord. Rutaceæ. Habitat, Southern Africa. The yield is from ½ to 1½ per cent.
Camphor.	From the preparation of crude camphor. Nat. Ord. Laurineæ. Habitat, Asia.
Canella.	From the bark of *Canella alba.* Nat. Ord. Canellaceæ. Habitat, Southern United States. The yield is about from ½ to 1 per cent.
Capsicum.	From the fruit of *Capsicum fastigiatum.* Nat. Ord. Solanaceæ. Habitat, Southern and Central America. The yield is very small.
Cardamom.	From the fruit of *Elettaria repens.* Nat. Ord. Scitamineæ. Habitat, Hindostan. The yield is about 4 per cent.
Carrot.	From the fruit of *Daucus Carota.* Nat. Ord. Umbelliferæ. Indigenous to Northern Asia. The yield is very small.
Cascarilla.	From the bark of *Croton Eluteria.* Nat. Ord. Euphorbiaceæ. Indigenous to the Bahama Islands. The yield of oil is about 1½ per cent.
Catnep.	From the leaves and tops of *Nepeta Cataria.* Nat. Ord. Labiatæ. Habitat, Europe. The yield is small.
Celery.	From the fruit of *Apium graveolens.* Nat. Ord. Umbelliferæ. Habitat, Europe.
Citronella	From the leaves of *Andropogon Nardus.* Habitat, Ceylon. Contains a terpene, citronellol, and a heptoic aldehyde. Used in perfumery.
Clove Cinnamon.	From *Persea caryophyllata.*
Curcuma.	From the rhizome of *Curcuma longa.* Nat. Ord. Zingiberaceæ. Habitat, India. The yield is about 1 per cent.
Cyna.	From the flowers of *Artemisia maritima.* Nat. Ord. Compositæ. Habitat, Asia. A pale yellow oil. The yield is about 2 per cent.
Dahlia.	From the tubers of *Dahlia pinnata.*
Elder (European).	From the flowers of *Sambucus nigra.* Nat. Ord. Caprifoliaceæ. Habitat, Europe. The yield is about from ¼ to ½ per cent.
Feverfew.	From *Pyrethrum Parthenium.* Nat. Ord. Compositæ. Habitat, Europe.
Galangal.	From the rhizome of *Alpinia officinarum.* Nat. Ord. Zingiberaceæ. Habitat, China. The yield of oil is about ½ per cent.
Ginger.	From the rhizome of *Zingiber officinale.* Nat. Ord. Scitamineæ. Habitat, Jamaica. The yield is about from 1 to 2 per cent.
Ginger Grass.	From the flowers of *Andropogon Schœnanthus.*
Golden Rod.	From the leaves of *Solidago odora.*
Heliotrope.	From the flowers of *Heliotropium peruvianum* and *H. grandiflorum.*
Hop.	From the strobiles of *Humulus Lupulus.* Nat. Ord. Urticaceæ. Habitat, North America. The yield is about 0.8 per cent.
Horsemint.	From the leaves and flowers of *Monarda punctata.* Nat. Ord. Labiatæ. Habitat, United States.
Hyssop.	From the herb of *Hyssopus officinalis.* Nat. Ord. Labiatæ. Habitat, Southern Europe. The yield is about from ¼ to ½ per cent.
Ihlang-Ihlang.	From *Unona odoratissima.*
Indian Cannabis.	From *Cannabis sativa.* Nat. Ord. Urticaceæ. Habitat, Asia.
Inula.	From the root of *Inula Helenium.* Nat. Ord. Compositæ. Habitat, Europe. The yield is very small.
Jessamine.	From the flowers of *Jasminum grandiflorum* and *J. fragrans.* Nat. Ord. Jasmineæ. The yield is very small. Used in perfumery.
Laurel.	From *Laurus nobilis.* Nat. Ord. Lauraceæ. Habitat, Southern Europe. The yield of oil is about 20 per cent.
Lilac.	From the flowers of *Syringa vulgaris.* Nat. Ord. Oleaceæ. Used in perfumery.
Lily of the Valley.	From the flowers of *Convallaria majalis.* Nat. Ord. Liliaceæ. The yield is very small. Used in perfumery.

Unofficial Oxygenated Oils.—*Continued.*

Oil of Linden.	From the inflorescence of different species of *Tilia*. Nat. Ord. Tiliaceæ. Habitat, Europe and America. The yield is about from $\frac{1}{20}$ to $\frac{1}{10}$ per cent.
Lovage.	From the root of *Levisticum officinale*. Nat. Ord. Umbelliferæ. Habitat, Europe.
Mace.	From the arillode of *Myristica fragrans*. Nat. Ord. Myristicaceæ. Habitat, Molucca Islands. The yield is about 8 per cent.
Marrubium.	From *Marrubium vulgare*. Nat. Ord. Labiatæ. Habitat, Europe and Asia. The yield is small.
Marsh Tea.	From the leaves of *Ledum palustre*. Nat. Ord. Ericaceæ. Habitat, Europe and Asia. The yield is variable, but about from ¾ to 1½ per cent.
Masterwort.	From *Heracleum lanatum*. Nat. Ord. Umbelliferæ. Habitat, United States. The yield is small.
Matico.	From the leaves of *Piper angustifolium*. Nat. Ord. Piperaceæ. Habitat, tropical America. The yield is about 1½ per cent.
Matricaria.	From the flowers of *Matricaria Chamomilla*. Nat. Ord. Compositæ. Habitat, Europe and United States. The yield is about ¼ per cent.
Melissa.	From the leaves and tops of *Melissa officinalis*. Nat. Ord. Labiatæ. Habitat, Europe and United States. The yield is about from ⅛ to ¼ per cent.
Mignonette.	From the flowers of *Reseda odorata*. Nat. Ord. Resedaceæ. Habitat, Southern France. The yield is very small. Used in perfumery.
Mountain Balm.	From the leaves of *Eriodictyon californicum*. Nat. Ord. Hydrophyllaceæ. Habitat, California.
Myrrh.	From the gum-resin of *Commiphora Myrrha*. Nat. Ord. Burseraceæ. Habitat, Arabia. The yield is about from 2 to 2½ per cent.
Olibanum.	From *Boswellia Carterii*. Nat. Ord. Burseraceæ. Habitat, Arabia. The yield is about from 4 to 8 per cent.
Parsley.	From the fruit of *Petroselinum sativum*. Nat. Ord. Umbelliferæ. Habitat, Southern Europe. The yield is about 1½ per cent.
Patchouly.	From *Pogostemon Patchouly*. Nat. Ord. Labiatæ. Habitat, East India.
Phellandrium.	From the fruit of *Œnanthe Phellandrium*. Nat. Ord. Umbelliferæ. The yield is about 1½ per cent.
Red Cedar.	From *Juniperus virginiana*. Nat. Ord. Coniferæ. Habitat, Canada and United States.
Rhodium.	From the root of *Convolvulus Scoparius*. Habitat, Canary Islands. The oil of rhodium sold in pharmacy is usually a factitious article, made by mixing 1 part of oil of rose with 20 parts of oil of copaiba. It is used as a lure for rats.
Saffron.	From *Crocus sativus*. Nat. Ord. Irideæ. Habitat, Europe. The yield is about 1 per cent.
Serpentaria.	From the rhizome and roots of *Aristolochia Serpentaria* and *A. reticulata*. Nat. Ord. Aristolochiaceæ. Habitat, Virginia. The yield is about ½ per cent.
Summer Savory.	From the herb of *Satureja hortensis*. Nat. Ord. Labiatæ.
Sweet Basil.	From *Ocymum Basilicum*. Nat. Ord. Labiatæ. Habitat, Asia and Africa.
Sweet Cicely.	From *Osmorhiza longistylis*. Nat. Ord. Umbelliferæ.
Sweet Marjoram.	From *Origanum marjorana*. Nat. Ord. Labiatæ.
Sweet Violet.	From the flowers of *Viola odorata*. Nat. Ord. Violaceæ.
Tansy.	From the leaves of *Tanacetum vulgare*. Nat. Ord. Compositæ. Habitat, Europe and North America. The yield is variable, but about ¼ to ½ per cent.
Tea.	From the leaves of *Thea sinensis*. Nat. Ord. Ternstrœmiaceæ. Habitat, China. The yield is about from ½ to 1 per cent.
Thuja.	From the branches of *Thuja occidentalis*. Nat. Ord. Coniferæ. Habitat, Canada and United States. The yield is variable, but about 1 per cent.
Tuberose.	From the flowers of *Polianthes tuberosa*. Nat. Ord. Amaryllidaceæ.
Verbena (Lemon-grass).	From *Andropogon Citratis*. A grass cultivated in Ceylon and Singapore.
Wormwood.	From the herb of *Artemisia Absinthium*. Nat. Ord. Compositæ. Habitat, Europe. The yield is about ½ per cent.
Zedoary.	From the rhizome of *Curcuma Zedoaria*. Nat. Ord. Zingiberaceæ. Habitat, East India Islands.

Stearoptens from Volatile Oils.

CAMPHORA. *U.S.* Camphor.

$C_{10}H_{16}O = 151.66.$

A stearopten (having the nature of a ketone) obtained from *Cinnamomum Camphora* (Linné) Nees et Ebermaier (nat. ord. *Laurineæ*), and purified by sublimation.

Camphor is sometimes sublimed in powder by conducting the vapor into a large chamber (see Sublimation, page 171). This powder is often compressed into oblong cakes, forming *compressed camphor*.

It is in white, translucent masses of a tough consistence and crystalline structure, readily pulverizable in the presence of a little alcohol, ether, or chloroform. It has the sp. gr. 0.995, melts at 175° C. (347° F.), boils at 204° C. (399.2° F.), sublimes without residue, and burns with a luminous, smoky flame. It has a penetrating odor and a pungent taste, dissolves readily in alcohol, ether, chloroform, carbon disulphide, benzin, and fixed and volatile oils, and is sparingly soluble in water. It has the property of softening resins, and liquefies when triturated with such substances as menthol, thymol, phenol, or chloral hydrate.

Preparation.—Refined camphor is usually made by subliming in circular cakes the crude granular camphor imported from China and Japan. The vessels in which the camphor is put are of cast iron, circular, from twelve to fifteen inches or more in diameter, and four inches deep, with perpendicular sides, and a ledge at top, on which the cover rests. This consists of sheet-iron, with a hole through the centre about an inch in diameter, over which a small hollow cone of sheet-iron is placed loosely. The crude camphor, mixed with lime,—the object of which is said to be to combine with the moisture present, which would interfere with the due solidification of the camphor vapor,—is placed in the iron vessels described, of which from twenty to fifty are arranged in a long sand-bath. Heat is then applied until the camphor melts, after which the heat is kept as nearly uniform as possible, so that the vaporization may take place regularly, without violent ebullition. The camphor sublimes on the lower surface of the lid in a solid circular cake, care being taken, by the occasional removal of the iron cone and clearing of the opening by means of a knife, to allow the escape of any excess of the vapor: the round hole in the cakes is thus accounted for.

Uses.—Camphor is a stimulant. It is given in doses of five to ten grains (0.3 to 0.6 Gm.). There are three official preparations in which camphor is used, and it is an ingredient in six others,—soap liniment, camphorated tincture of opium, belladonna liniment, compound liniment of mustard, compound powder of morphine, and camphor cerate.

Official Preparations.

Aqua Camphoræ . . . . . Camphor Water.	Made by dissolving 8 Gm. of camphor in 5 C.c. of alcohol, triturating with 5 Gm. of precipitated calcium phosphate, and filtering this with distilled water until 1000 C.c. have been obtained (see page 288).
Ceratum Camphoræ . . . Camphor Cerate.	Made by mixing 100 Gm. of camphor liniment, 300 Gm. of white wax, and 600 Gm. of lard.
Linimentum Camphoræ . Camphor Liniment.	Made by dissolving 200 Gm. of camphor in 800 Gm. of cotton-seed oil (see page 340).
Spiritus Camphoræ . . . Spirit of Camphor.	Made by dissolving 100 Gm. of camphor in alcohol sufficient to make 1000 C.c. (see page 230). Dose, five to forty minims (0.3 to 2.4 C.c.).

CAMPHORA MONOBROMATA. *U. S.* Monobromated Camphor.

$C_{10}H_{15}BrO$; 230.42.

Preparation.—This compound of camphor may be made by Prof. Maisch's process, as follows. Four ounces of bromine are introduced gradually into a retort in which thirteen ounces of camphor have been previously placed. In fifteen or twenty minutes a brisk reaction will commence. When this subsides, eight or nine ounces more of bromine are to be poured in, in four portions, waiting after each addition until the reaction ceases. The liquid in the retort is now to be heated to about 132° C. (270° F.), then cooled, and sufficient petroleum benzin added to dissolve the crystalline mass. The crystals which are formed on cooling may be purified by recrystallization from benzin or hot alcohol.

Camphora Monobromata. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, prismatic needles or scales, permanent in the air, and unaffected by light. At 76° C. (168.8° F.) it melts, and it may be sublimed at a slightly higher temperature. At 274° C. (525.2° F.) it boils without decomposition, and is finally volatilized without leaving a residue.	Mild, camphoraceous odor and taste; neutral reaction.	Almost insoluble.	Freely soluble.	Freely soluble in ether, chloroform, hot benzin, and fixed and volatile oils; slightly soluble in glycerin.

Tests for Identity.
It is soluble, without decomposition, in cold, concentrated sulphuric acid, and will again separate unaltered if the solution be poured into water.

Uses.—Monobromated camphor is given as a nervous sedative, in doses of five grains (0.3 Gm.).

Official Substances containing Nitrogenated and Sulphurated Oils with Allied Products.

AMYGDALA AMARA. *U. S.* Bitter Almond.

The seed of *Prunus Amygdalus*, var. *amara* De Candolle (nat. ord. *Rosaceæ*).

Bitter almond contains *amygdalin*, $C_{20}H_{27}NO_{11}$, a glucoside which splits into benzyl-aldehyd, or oil of bitter almond, hydrocyanic acid, and glucose, under the influence of emulsin, or synaptase, a ferment which becomes active in the presence of water.

$$\underset{\text{Crystallized Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Dextroglucose.}}{2(C_6H_{12}O_6)} + \underset{\text{Hydrocyanic Acid.}}{HCN} + \underset{\text{Oil of Bitter Almond.}}{C_7H_6O} + \underset{\text{Water.}}{H_2O}.$$

It also contains about 35 per cent. of fixed oil, mucilage, sugar, etc., with a trace of tannin in the testa. Bitter almond is used in making the volatile oil, and in syrup of almond.

OLEUM AMYGDALÆ AMARÆ. *U. S.* Oil of Bitter Almond.

A volatile oil obtained from Bitter Almond by maceration with water, and subsequent distillation.

Preparation.—As stated above, oil of bitter almond, or benzyl-aldehyd, is produced as the result of the reaction of emulsin on amyg-

dalin in aqueous mixture: it therefore does not pre-exist in the almond, and cannot be obtained from sweet almond, because amygdalin is not present in the latter.

$$\underset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + \underset{\text{Water.}}{2H_2O} = \underset{\text{Benzyl-aldehyd.}}{C_7H_6O} + \underset{\text{Glucose.}}{2C_6H_{12}O_6} + \underset{\text{Hydrocyanic Acid.}}{HCN.}$$

The process is simply to make a mixture of the bitter almond cake (obtained after the fixed oil has been extracted) with water, and distil it by passing a current of steam through it. Artificial benzyl-aldehyd, which is identical with the product obtained from the almond, is now made from toluol, C_7H_8. By the action of chlorine upon the hot toluol, benzyl chloride, $C_6H_5CH_2Cl$, results, and this yields benzyl-aldehyd on distillation with lead nitrate and water in an atmosphere of carbon dioxide. Artificial benzyl-aldehyd is free from hydrocyanic acid, but is liable to retain traces of chlorine compounds. This artificial product must not be confounded with nitrobenzol, or *oil of myrbane*, which is made by reacting on benzol with nitric acid. Nitrobenzol is made in large quantities for perfuming soap: its odor is similar to, but by no means identical with, that of oil of bitter almond.

Uses.—Oil of bitter almond is sedative and poisonous if it contains hydrocyanic acid. The dose is from one-half to one minim (0.03 to 0.06 C.c.). It is used for flavoring.

Oleum Amygdalæ Amara. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A clear, colorless or yellowish, thin, and strongly refractive liquid. Sp. gr. 1.060 to 1.070 at 15° C. (59° F.). Boiling point, about 180° C. (356° F.). Optically inactive.	Peculiar aromatic odor; bitter and burning taste; neutral reaction; but when kept for some time it assumes an acid reaction, due to the formation of benzoic acid.	At 15° C. (59° F.), 300 parts.	Soluble in all proportions.	Soluble in all proportions of ether, also in nitric acid, at the ordinary temperature, without evolution of nitrous vapors.

Tests for Identity.	Impurities.	Test for Impurity.
The presence of *artificial oil containing chlorinated products* may be detected in the following manner. Fold a small strip of filter paper in the form of a taper, saturate it with the Oil, and lay it into a small porcelain capsule. Set this capsule into a larger one, and provide a large beaker to be inverted over the capsule containing the taper. Then, having moistened the inner surface of the beaker with distilled water, ignite the taper, immediately invert the beaker over the capsule, and allow the products of combustion to be absorbed by the water in the beaker. If the beaker be now rinsed with a little distilled water, and the liquid filtered, the filtrate should yield no turbidity with silver nitrate T.S. If 5 C.c. of the Oil be vigorously shaken, in a flask, with 50 C.c. of a cold, saturated solution of sodium bisulphite, and the mixture heated for a few minutes on a water-bath, the odor of the Oil should disappear, and a nearly clear solution be formed, without the separation of any oily drops on the surface of the liquid (absence of *most other volatile oils* and of *nitrobenzol*).	Presence of Hydrocyanic Acid.	If 10 drops of the Oil, dissolved in a little alcohol, be shaken with a few drops of a strong solution of sodium hydrate, then with a little ferrous sulphate T.S., and finally mixed with a slight excess of hydrochloric acid, a blue precipitate will be produced.

Official Preparation.

Aqua Amygdalæ Amaræ. Bitter Almond Water.	Made by dissolving 1 C.c. of oil of bitter almond in 999 C.c. of distilled water (see page 287). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

PRUNUS VIRGINIANA. *U. S.* Wild Cherry.

The bark of *Prunus serotina* Ehrhart (nat. ord. *Rosaceæ*), collected in autumn.

This bark contains amygdalin, emulsin, tannin, bitter principle, starch, resin, etc. As with bitter almond, contact with water results in the production of oil of bitter almond and hydrocyanic acid: as both of the latter principles are volatile and active, all the preparations of wild cherry should be made without heat. An insoluble precipitate of altered tannin is often noticed in old fluid extract of wild cherry. Wild cherry bark is sedative and tonic.

Official Preparations.

Infusum Pruni Virginianæ ...... Infusion of Wild Cherry.	Made with 40 Gm. of wild cherry and sufficient water to make 1000 C.c. (see page 349). Dose, two fluidounces (59 C.c.).
Syrupus Pruni Virginianæ ...... Syrup of Wild Cherry.	Made with 150 Gm. of wild cherry, 700 Gm. of sugar, 150 C.c. of glycerin, and water to make 1000 C.c. (see page 308). Dose, a tablespoonful (14.7 C.c.).
Extractum Pruni Virginianæ Fluidum. Fluid Extract of Wild Cherry.	Made with a menstruum of water, glycerin, and alcohol (see page 417). Dose, one fluidrachm (3.7 C.c.).

ACIDUM HYDROCYANICUM DILUTUM. *U. S.* Diluted Hydrocyanic Acid.

[PRUSSIC ACID.]

A liquid composed of 2 per cent., by weight, of absolute Hydrocyanic Acid [HCN = 26.98], and 98 per cent. of water.

	Metric.	Old form.
Potassium Ferrocyanide, in coarse powder	20 Gm.	4 oz. av.
Sulphuric Acid	8 C.c.	1½ fl. oz.
Water	65 C.c.	12½ fl. oz.
Distilled Water, a sufficient quantity.		

Place the Potassium Ferrocyanide in a tubulated retort, and add to it 40 C.c. [old form 7½ fl. oz.] of Water. Connect the neck of the retort (which is to be directed upward), by means of a bent tube, with a well-cooled condenser, the delivery tube of which terminates in a receiver surrounded with ice-cold water, and containing 65 C.c. [old form 12½ fl. oz.] of Distilled Water. All the joints of the apparatus, except the neck of the receiver, having been made air-tight by means of well-fitting corks, pour into the retort, through the tubulure, the Sulphuric Acid, previously diluted with 25 C.c. [old form 5 fl. oz.] of Water. Gently mix the contents of the retort, and then heat it, in a sand-bath, so as to keep the liquid in brisk ebullition, until about one-half of its volume has passed over into the receiver. Detach the receiver, and assay a small portion of the contents by the method given below. Then add to the remainder so much Distilled Water as may be required to bring the product to the strength of two per cent., by weight, of absolute Hydrocyanic Acid.

If to 1 C.c. of the Acid, rendered alkaline by potassium hydrate T.S., a few drops, each, of ferrous sulphate T.S. and ferric chloride T.S. be added, and the mixture then acidulated with hydrochloric acid, a blue precipitate will be formed.

To ascertain the percentage strength, mix in a flask (of the capacity of about 100 C.c.) 0.27 Gm. of Hydrocyanic Acid (obtained by distillation as above directed) with sufficient water and magnesia to make an opaque mixture of about 10 C.c. Add to this 2 or 3 drops of potassium chromate T.S., and then, from a burette, decinormal silver nitrate V.S., until a red tint is produced which does not again disappear by shaking. Each C.c. of silver nitrate V.S. used indicates 1 per cent of absolute Hydrocyanic Acid. After ascertaining the strength of the distillate, dilute it with Distilled Water so as to bring it to the strength of 2 per cent. of absolute acid. Lastly, test the finished product again, when 1.35 Gm. of it should require, for complete precipitation, 10 C.c. of decinormal silver nitrate V.S.

Diluted Hydrocyanic Acid may also be prepared, extemporaneously, in the following manner:

	Metric.	Old form.
Silver Cyanide	6 Gm.	50½ grains.
Hydrochloric Acid	5 C.c.	48 minims.
Distilled Water	55 C.c.	1 fl. oz.

Mix the Hydrochloric Acid with the Distilled Water, add the Silver Cyanide, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid.

Diluted Hydrocyanic Acid should be kept in small, dark amber-colored, cork-stoppered vials, in a cool place.

$$\underset{\text{Potassium Ferrocyanide.}}{(K_4FeCy_6)_2} + \underset{\text{Sulphuric Acid.}}{(H_2SO_4)_6} = \underset{\text{Potassium Ferrous Ferrocyanide (Everitt's Salt).}}{K_2Fe_2Cy_6} + \underset{\text{Potassium Acid Sulphate.}}{(KHSO_4)_6} + \underset{\text{Hydrocyanic Acid.}}{6HCy}$$

Diluted Hydrocyanic Acid is a colorless liquid, of a characteristic odor and taste resembling those of bitter almond, and having a slightly acid reaction. On being heated, it is completely volatilized. If to the Acid, rendered alkaline by potassa, a little ferrous sulphate and ferric chloride be added, and the mixture be acidulated with hydrochloric acid, a blue precipitate will make its appearance.

It is a solution of the very poisonous compound HCN in water. *Cyanogen*, CN or Cy, does not exist ready-formed in nature, but compounds of it are found in plants and animal fluids. It is generally the product of chemical reaction, and was the first compound radical discovered. It is more closely related to the halogens in the character of its combinations than any other class of bodies. It unites with hydrogen to form hydrocyanic acid, HCN, and the compounds with metals and bases are termed cyanides. These have been considered in the previous chapters.

Scheele's hydrocyanic acid is a stronger solution, containing about 5 per cent. of anhydrous acid. Its use should be discouraged as unnecessary, tending to create confusion, and dangerous. Diluted hydrocyanic acid frequently becomes decomposed upon keeping, a black insoluble precipitate which contains paracyanogen forming in the bottle. This

decomposition may be prevented by the addition of a small quantity of sulphuric or hydrochloric acid. The use of cork-stoppered vials is said to be an advantage. Alcohol has not proved a good preservative, and hence was not adopted in the U. S. P. 1890 formula.

Uses.—Diluted hydrocyanic acid is sedative in doses of one to three minims (0.06 to 0.18 C.c.). Potassium cyanide is often prescribed in combination with an acid and syrup, so that hydrocyanic acid may be generated and dissolved.

SINAPIS ALBA. *U. S.* White Mustard.

The seed of *Brassica alba* (Linné) Hooker filius et Thompson (nat. ord. *Cruciferæ*).

White mustard seed contains *sinalbin*, $C_{30}H_{44}N_2O_{16}S_2$, a crystalline glucoside, which, under the influence of a peculiar ferment, *myrosin*, and water, is split into *acrinyl thiocyanate*, C_8H_7NOS, which is a pungent, volatile oil (this is not the official oil of mustard), *sinapine sulphate*, $C_{16}H_{23}NO_5H_2SO_4$, and glucose. The seed contains in addition 20 per cent. of fixed oil, mucilage, gum, etc., but no starch. It is used as a stimulant, condiment, and emetic; externally, it is rubefacient.

SINAPIS NIGRA. *U. S.* Black Mustard.

The seed of *Brassica nigra* (Linné) Koch (nat. ord. *Cruciferæ*).

Black mustard contains potassium myronate ($KC_{10}H_{18}NS_2O_{10}$), *myrosin*, a ferment, 25 per cent. of fixed oil, mucilage, etc. Under the influence of the myrosin and water the potassium myronate is converted into allyl iso-thiocyanate, or volatile oil of mustard. This action takes place at ordinary temperatures, and explains the pungency of aqueous mixtures of ground mustard.

Official Preparation.

Charta Sinapis . . Mustard Paper. Made by first depriving the ground black mustard of fixed oil by percolation with benzin, drying, mixing with solution of india-rubber, and spreading on paper. It must be kept excluded from moisture, to prevent the generation of the volatile oil before it is needed (see Part V.).

OLEUM SINAPIS VOLATILE. *U. S.* Volatile Oil of Mustard.

A volatile oil obtained from Black Mustard by maceration with water, and subsequent distillation.

Chemically, this oil is *allyl iso-thiocyanate;* it is also called *allyl sulphocyanide:* its production is explained in the preceding article. It is prepared artificially by distilling *allyl sulphate* with *potassium thiocyanate.*

Oleum Sinapis Volatile. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A colorless or pale yellow, limpid, and strongly refractive liquid. Specific gravity, 1.018 to 1.029 at 15° C. (59° F.). Boiling point, 148° to 150° C. (298.4° to 302° F.).	Pungent and acrid odor and taste; neutral reaction.	Freely soluble.	Freely soluble in ether or in carbon disulphide.

Tests for Identity.	Impurities.	Tests for Impurities.
If to 3 Gm. of the Oil, 6 Gm. of sulphuric acid be gradually added, the liquid being kept cool, the mixture, upon subsequent agitation, will evolve sulphur dioxide, but will remain of a light yellow color, and at first perfectly clear, becoming afterwards thick and occasionally crystalline, while the pungent odor of the Oil will disappear. If a mixture of 3 Gm. of the Oil and 3 Gm. of alcohol be shaken, in a small flask, with 6 Gm. of ammonia water, it will become clear after standing for some hours, rapidly at 50° C. (122° F.), and usually deposit, without becoming colored, crystals of thiosinamine (allyl-thio-urea, $CS.N_2H_3(C_3H_5)$). To determine the proportion of thiosinamine obtainable from the Oil, decant the mother-water from the crystals, and evaporate it gradually in a tared capsule, on a water-bath, adding fresh portions only after the ammoniacal odor of each preceding portion has disappeared. Then add the crystals from the flask to those in the capsule, rinsing them out of the flask with a little alcohol, and heat the capsule on a water-bath until its weight remains constant. The amount of thiosinamine thus obtained from 3 Gm. of the Oil should be not less than 3.25 Gm., nor more than 3.5 Gm. After cooling, thiosinamine forms a brownish, crystalline mass, fusing at 70° C. (158° F.), and having a leek-like, but no pungent, odor. The mass should be soluble in 2 parts of warm water, forming a solution which should not redden blue litmus paper, and which possesses a somewhat bitter, not persistent taste.	Alcohol, Chloroform, Carbon Disulphide, Petroleum, or Fatty Oils.	If a portion of the Oil be heated in a flask connected with a well-cooled condenser, it should distil completely between 148° and 150° C. (298.4° and 302° F.), and both the first and the last portion of the distillate should have the same specific gravity as the original Oil.
	Phenols.	If a small portion of the Oil be diluted with 5 times its volume of alcohol, and a drop of ferric chloride T.S. be added, no blue or violet color should be produced.

Volatile oil of mustard is used as a rubefacient.

Official Preparation.

Linimentum Sinapis Compositum . 30 C.c. volatile oil of mustard, 200 C.c. fluid extract of
Compound Liniment of Mustard. mezereum, 60 Gm. camphor, 150 C.c. castor oil, and sufficient alcohol to make 1000 C.c. (see page 341).

ALLIUM. *U. S.* Garlic.

The bulb of *Allium sativum* Linné (nat. ord. *Liliaceæ*).

Garlic contains a volatile sulphurated oil known as allyl sulphide, $(C_3H_5)_2S$, mucilage, albumen, etc. The volatile oil is the active principle. It may be obtained artificially by decomposing allyl iodide with an alcoholic solution of potassium sulphide. Garlic is stimulant, expectorant, and vesicant.

Official Preparation.

Syrupus Allii . . Made by macerating 200 Gm. of fresh garlic in 300 C.c. of diluted acetic
Syrup of Garlic. acid, expressing, adding additional liquid, expressing, and filtering, then dissolving 800 Gm. of sugar in it by agitation (see page 301). Dose, one fluidrachm (3.7 C.c.).

Unofficial Volatile Oils and Allied Products.

Oil of Asafetida.	From the gum-resin of *Ferula Narthex*. Nat. Ord. Umbelliferæ. Habitat, Western Thibet. The yield is about 6 to 9 per cent.
Bitter Candytuft.	*Iberis amara* contains a sulphurated volatile oil.
Common Scurvy Grass.	From the herb of *Cochlearia officinalis*. Nat. Ord. Cruciferæ. Habitat, Europe.

Unofficial Volatile Oils and Allied Products.—*Continued.*

Cress.	The seed of *Lepidium sativum*. Nat. Ord. Cruciferæ. Contains a sulphurated volatile oil.
Garlic.	From the bulb of *Allium sativum*. Nat. Ord. Liliaceæ. Habitat, Europe and Asia. The yield of oil is about ¼ per cent.
Hedge Garlic.	*Alliaria officinalis*. Nat. Ord. Cruciferæ. Contains a sulphurated oil.
Horseradish.	From the root of *Cochlearia Armoracia*. Nat. Ord. Cruciferæ. Habitat, Europe. The yield is about $\frac{1}{20}$ per cent.
Radish.	*Raphanus sativa* contains a sulphurated volatile oil.
Sagapenum.	From *Ferula persica*. The yield of volatile oil is small.
Shepherd's Purse.	The seeds of *Capsella bursa-pastoris* contain a sulphurated volatile oil.
Wallflower.	The seed of *Cheiranthus annuus* contains a sulphurated volatile oil.
Wild Mustard.	The seed of *Sisymbrium nasturtium* contains a sulphurated volatile oil.
Wild Radish.	The seed of *Raphanus Raphanistrum* contains a sulphurated volatile oil.
Allyl Tri-bromide, $C_3H_5Br_3$.	A slightly yellowish liquid, identical with *Tri-brom-hydrin*; sedative and anodyne in its action. Dose, five or six drops.
Apiol.	A yellowish, oily liquid, obtained from Apium petroselinum. Dose, fifteen grains, as an emmenagogue.
Apiol Camphor (crystallized), $C_{12}H_{14}O_4$.	Dose, fifteen grains.
Thiosinamin, Allyl-sulpho-urea, Allyl-sulpho-carbamide, $CS\begin{cases}NH_2\\NH(C_3H_5)\end{cases}$.	Used in tuberculous diseases, by subcutaneous injection, of 4½ to 7 grains (0.3 to 0.45 Gm.), in 15-per-cent. alcoholic solution.

QUESTIONS ON CHAPTER LV.

VOLATILE OILS.

What are volatile oils, and whence are they obtained?
Into what four classes may they be divided?
What is the characteristic of each of these divisions?
Of what two principles do volatile oils proximately consist?
How may they be separated?
Why are some stearoptens called camphors?
What is the color of most volatile oils when pure?
What is the most characteristic feature of volatile oils?
What variation exists in the specific gravity of volatile oils?
What are good solvents of volatile oils, and of what substances are they solvents?
What effect does exposure to light and air have on them?
How should they be kept?
What effect does strong nitric acid have upon them?
What effect does strong iodine have upon them?
How are they affected by alkalies?
How may their adulteration with fixed oils be detected?
How may the presence of alcohol be detected?
How may the presence of inferior qualities of the same kind of oil be detected?
In what ways are volatile oils obtained from plants?
What is the method most frequently employed?
What is the general formula for this process?
How should dried substances be treated before being subjected to distillation?
What purposes does water serve in distilling vegetable substances along with it?
When vegetable substances contain volatile oils which do not readily distil at the temperature of boiling water, how are they treated?
Where oils are injured by heat, and it is desirable to distil them at as low a temperature as possible, how may the distillation be accomplished?
What will be the effect where too much water is used?
What will be the effect where not enough water is used?

What is the process known as cohobation?
How may oils be freed from the disagreeable odor which they are apt to have when first procured?
When altered by exposure to air, how may they be partially restored to their former quality?
What is meant by distillation "per se"?
In what cases and for what reason is this used?
Expression—Is this a good method of obtaining oils?
What is the principal objection to it?
What is meant by the process of solution or absorption?
How is the process of maceration conducted?
How is the process of digestion conducted?
What is the process known as enfleurage?
How is the "pneumatic process" conducted?
How are oils prepared by the "percolation process"?
Sweet orange peel—Give the Latin name. Whence is it obtained?
To what does it owe its virtues, and for what is it used?
What are the official preparations of it?
Bitter orange peel—Give the Latin official name. Whence is it obtained?
What principles does it contain? What is the dose?
What are official preparations of it?
Oil of orange peel—Give the Latin official name. How is it obtained?
What is its composition? Give description, specific gravity, and solubility.
For what is it used?
What are official preparations of it?
Orange flowers—What is the Latin official name? From what plants is it obtained?
For what are they used?
How may fresh orange flowers be preserved?
What official preparation is there of them?
Oil of orange flowers—What is its synonyme?
How is it obtained, and where does it come from?
What is its composition? Describe it and give its specific gravity.
What is the best quality called?
What is "neroli bigarade"?
What is "essence de petit grain"?
For what is this oil used?
What is lemon peel, and for what is it used?
What does it contain?
Oil of lemon—What is the Latin official name? How is it obtained?
What is its chemical composition? Give description, specific gravity, and solubility.
How may it be preserved from the effects of oxidation?
What official preparation is there of it?
Oil of bergamot—How and whence is it obtained?
From what does it derive its name? Give description, specific gravity, and solubility.
What is an "ecuelle," and how is it used?
For what is this oil used?
Peppermint—What is the Latin official name? What part of the plant is official?
To what are its properties due?
Oil of peppermint—Give Latin name, description, specific gravity, and solubility.
To what does oil of peppermint owe its odor?
Menthol—Describe odor, taste, chemical reaction, and solubility. What is its melting-point?
What is its boiling-point?
For what is it used?
What are the official preparations of oil of peppermint?
Spearmint—What is the Latin official name? To what does it owe its properties?
What is the yield of volatile oil?
Oil of spearmint—Describe odor, taste, chemical reaction, and solubility.
Give its specific gravity.
What does it contain? For what is it used?
What are the official preparations of it?

Oil of lavender flowers—What is the Latin name? Describe odor, taste, chemical reaction, and solubility.

What is its specific gravity?

What kind of an oil is it, and what does it contain?

What preparations of it are official?

How may the presence of alcohol be detected?

Where does the best quality come from?

Oil of rosemary—What is the Latin name? Give description and specific gravity.

How is it obtained?

Of what does it consist?

In what preparations is it used?

Hedeoma—What is its synonyme? Where does it come from?

To what does it owe its virtues?

What are its medicinal properties?

Oil of pennyroyal—What is the Latin name? Give description and specific gravity. What is its solubility? What is the dose?

Marrubium—What is its synonyme? What part of the plant is official?

What does it contain?

What are its medicinal properties?

Melissa—What is its synonyme? What part of the plant is official?

To what does it owe its properties, and what are they?

Oil of thyme—What is the name of the herb?

Give description and specific gravity. Describe the odor, taste, chemical reaction, and solubility.

By what name is this oil known commercially?

What is the difference between the red oil and the white oil?

Does this oil vary in composition?

Of what does the more volatile portion consist? What is the less volatile portion?

What is the formula in symbols of the latter? Describe the odor, taste, and chemical reaction.

In what other oil is this substance found?

For what purpose is oil of thyme used?

Salvia—What is its synonyme? What part of the plant is official?

Of what does its volatile oil consist?

For what is it used?

Scutellaria—What is the name of the plant from which it is derived?

What is its synonyme? What does it contain? For what is it used?

What official preparation is made of it?

Caraway—From what plant is it derived?

What does it contain? What are its medicinal properties?

Oil of caraway—What is its specific gravity. Describe the odor, taste, chemical reaction, and solubility. Of what does it consist?

Fennel—What is the Latin name? From what plant is it derived?

What does it contain? For what is it used?

Oil of fennel—What is its specific gravity? Describe odor, taste, chemical reaction, and solubility. Of what does it consist?

What official preparation is made of it?

Coriander—Whence is it derived?

How much volatile oil does it yield?

How much fixed oil does it yield?

Into what official preparation does it enter?

Oil of coriander—What is its specific gravity?

Describe odor, taste, chemical reaction, and solubility.

What is its chemical composition?

For what is it used?

Sumbul—From what plant is it derived?

What does it contain, and for what is it used?

What official preparation is made of it?

Anise—From what plant is it derived?

What does it contain? For what is it used?

Oil of anise—From what plants is it obtained?

Are these products identical? What is its specific gravity?

Describe odor, taste, chemical reaction, and solubility.

Of what does it consist?

What preparations of it are official?

Illicium—What is its synonyme?
What is the name of the plant from which this is derived?
How much volatile oil does it contain?
What other constituents has it?
Cinnamon—Give the Latin official name. What is cinnamon defined to be?
To what does cinnamon owe its virtues?
What other constituents are present?
Into how many official preparations does it enter?
In what one is it the sole active ingredient?
Oil of cinnamon—What is known as oil of cinnamon in commerce?
Are these two oils identical?
What is the difference in their specific gravities and other properties?
Of what does oil of cinnamon consist?
When slightly oxidized what is produced?
Upon further oxidation what is produced?
Why is cinnamon water made from Ceylon cinnamon cloudy?
What official preparations are made from it?
Cloves—What is the Latin name? What are cloves?
What two crystallizable principles do they contain?
What other constituents do they contain?
For what is it used?
Oil of cloves—Give description and specific gravity. What is the Latin name?
Describe odor, taste, chemical reaction, and solubility.
Of what does the oil of cloves consist?
How may these oils be separated?
What combination is formed when oil of cloves is mixed with concentrated solution of potassa?
What is the composition and specific gravity of light oil of cloves?
Heavy oil of cloves—Give description and specific gravity.
What is its boiling-point?
Of what does it consist, and what effect does it have on alkalies?
Into what principle may eugenic acid be converted?
What is its use?
Allspice—What is the Latin official name? What is it?
How much volatile oil does it contain? What else does it contain?
Oil of pimenta—What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What action does solution of potassa have upon it?
Of what does it consist?
For what is it used?
Oil of myrcia.—What is its synonyme? Whence is it obtained?
What action does solution of potassa have upon it?
Of what does it consist?
What official preparation is made from it?
Vanilla—Whence is it obtained?
What are its constituents?
Considered chemically, what is vanillin?
From what is artificial vanillin made?
Are the flavors of vanilla and artificial vanillin identical?
What causes the difference?
What official preparation is made from vanilla?
Oil of cajuput—From what is it obtained?
Describe odor, taste, and chemical reaction.
What is its composition, and what is it termed chemically?
What is its boiling-point? Its solubility? Its specific gravity?
To what is its green color owing?
Eucalyptus—From what tree is it obtained?
What are its constituents?
Upon which of these do the virtues depend?
What are its properties?
What official preparation is made from it?
Oil of eucalyptus—Whence is it obtained? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
Of what does it consist?
Myristica—What is it? What is the common name?

To what does it owe its activity?
How much fixed oil does it contain?
In how many official preparations is it found?
Oil of nutmeg—What is the Latin name?
Describe odor, taste, chemical reaction, and solubility.
Of what does it consist?
Expressed oil of nutmeg—What is this usually called?
How is it made? What is its chemical composition?
What official preparation is made from it?
Mace—What is the Latin name? What is mace?
What does it contain?
Is the fixed oil identical with the expressed oil of nutmeg?
Is this the commercial oil of mace?
Cascarilla—From what shrub or tree is it obtained?
What are its constituents? What is the dose?
Sassafras—What are its constituents?
For what is it used, and into what preparations does it enter?
Oil of sassafras—Describe it. What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What action does nitric acid have upon it?
Where is it largely produced, and what is the yield?
Of what does it consist?
How much safrol does it contain?
Wintergreen—What is the Latin name? Whence is it obtained?
What are its constituents?
What are its properties and use?
Oil of wintergreen—What is the Latin name?
Describe it and give specific gravity.
Of what does it consist?
What action does concentrated solution of soda or of potassa have upon it?
Describe odor, taste, chemical reaction, and solubility.
To what is its reddish color due?
How may its adulteration with chloroform or alcohol be detected?
How may the presence of oil of sassafras be detected?
What official preparation is made from it?
Calamus—What is its synonyme? What are its constituents?
What are its properties and use?
What official preparation is made from it?
Cardamom—Give the Latin name.
Whence is it obtained, and where does it come from?
What do the seeds contain? What is the specific gravity of the volatile oil?
How is it usually made?
When made in this way, is it pure?
Of what two preparations is it the principal ingredient?
Ginger—To what does it owe its virtues?
How much volatile oil does it contain?
What are the official preparations of it?
Camphor—What is the Latin name? Give the symbol and atomic weight.
What is camphor?
What is compressed camphor? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What are its melting- and boiling-points?
How is refined camphor usually made?
What is the dose?
What are the official preparations of camphor?
Monobromated camphor—Give Latin name, formula in symbols, and molecular weight.
Describe a process for making this.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Thymol—What is the formula in symbols? How is it obtained?
From what different plants has it been obtained?
In what respects does the phenol of the oil of *Thymus serpyllum* (Linn.) differ from thymol?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the impurity of carbolic acid be detected?
What are its properties and uses?
Bitter almond—What is the Latin name? What does it contain?
Into what is amygdalin decomposed in the presence of water? Describe rationale of process.
For what is bitter almond used?
Oil of bitter almond—Give Latin official name.
Does this oil pre-exist in the almond?
Why can it not be obtained from sweet almond?
How is it made? Describe rationale of process. What is the dose?
Is artificial benzyl-aldehyd identical with the product obtained from almond?
How is it made? Does it contain hydrocyanic acid?
What impurities is it likely to contain?
Is this artificial product identical with the oil of myrbane?
How is this latter substance made, and for what is it used?
Oil of bitter almond—Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Chloroform or alcohol; nitrobenzol.
What official preparation is made from it?
Wild cherry—What is the Latin name? Of what tree is this the bark?
When should it be collected?
What does it contain?
Why should the preparations of wild cherry be made without heat?
What are its properties?
What official preparations are made from it?
Diluted hydrocyanic acid—What is the Latin name? What is its synonyme?
How much absolute hydrocyanic acid does it contain?
How is it made? How may its strength of 2 per cent. be tested?
How may it be prepared extemporaneously? Give rationale of process.
How may it be identified?
What is cyanogen? Does it exist ready formed in nature?
Combined with hydrogen, what does it form?
Combined with metals and bases, what are formed?
What is Scheele's hydrocyanic acid?
When hydrocyanic acid is decomposed upon keeping what substance is formed?
How may its decomposition be prevented or lessened? What is the dose?
What is the effect of prescribing cyanide of potassium in combination with an acid?
White mustard—What is the Latin name? What does it contain?
Under the influence of myrosin and water, into what substances is sinalbin decomposed?
Is this volatile oil the official oil of mustard?
What are the other constituents of white mustard?
Does it contain starch? For what is it used?
Black mustard—What is the Latin name? What does it contain?
Under the influence of myrosin and water, into what is potassium myronate converted?
Does this action take place at ordinary temperatures?
What official preparation is made from black mustard?
Volatile oil of mustard—What is the Latin name? How is it obtained?
What is this oil chemically considered?
How is it prepared artificially? Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility.
At what temperature does it boil?
What action does sulphuric acid have upon it?
How may the presence of carbon disulphide be detected?
What is its use?
What official preparation contains it?
Garlic—What is the Latin officinal name? What does it contain?
What is the active principle?
How may it be obtained artificially?
What are the medicinal properties of garlic?
What official preparation is made from it?

CHAPTER LVI.

OFFICIAL DRUGS AND PRODUCTS CONTAINING VOLATILE OIL WITH SOFT RESIN.

PIPER. *U. S.* Pepper. [Black Pepper.]

The unripe fruit of *Piper nigrum* Linné (nat. ord. *Piperaceæ*).

Black pepper contains piperin, a neutral principle, 2 per cent. of volatile oil, a pungent resin, soluble in alcohol, ether, and alkaline solutions.

The volatile oil is a terpene, $C_{10}H_{16}$. Its principal use is as a condiment.

Official Preparation.

Oleoresina Piperis . . . Oleoresin of Pepper.	Made by percolating pepper with ether and evaporating the ether (see page 435). The yield is about 5 per cent. Dose, one to two minims (0.06 to 0.12 C.c.).

PIPERINUM. *U. S.* Piperin.

$C_{17}H_{19}NO_3 = 284.88.$

A neutral principle obtained from pepper, and obtainable also from other plants of the natural order *Piperaceæ*.

Preparation.—Piperin is obtained by treating pepper with alcohol, evaporating the tincture to the consistence of an extract, submitting the extract to the action of an alkaline solution, by which the oleaginous matter is converted into soap, washing the undissolved portion with cold water, separating the liquid by filtration, treating the matter left on the filter with alcohol, and allowing the solution thus obtained to evaporate spontaneously, or by a gentle heat. Crystals of piperin are deposited, and may be purified by alternate solution in alcohol or ether, and crystallization.

Piperin is decomposed by alkalies in alcoholic solution into *piperic acid*, $C_{12}H_{10}O_4$, and *piperidine*, $C_5H_{11}N$. It was formerly considered to be an alkaloid of feeble power.

Piperinum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, or pale yellowish, shining, four-sided prisms, permanent in the air. When heated to 130° C. (266° F.), Piperin melts. Upon ignition it emits alkaline vapors, and is consumed, leaving no residue.	Odorless; almost tasteless when first put in the mouth, but on prolonged contact producing a sharp and biting sensation; neutral reaction.	Almost insoluble.	At 16° C. (60° F.), Cold, 30 parts. Boiling, 1 part.	Very soluble in hot acetic acid; slightly soluble in ether.

Tests for Identity.

Concentrated sulphuric acid dissolves Piperin with a dark, blood-red color, which disappears on dilution with water. When treated with nitric acid, Piperin turns rapidly first orange, then red, and the acid acquires a yellow color, deepening to reddish as the crystals dissolve. On adding to this solution an excess of potassium hydrate T.S., the color is at first yellow, but upon boiling it deepens to blood-red.

Uses.—Piperin has been used as a stimulant and an antiperiodic. Its virtues, however, in this connection depend principally upon its impurities,—*i.e.*, adhering resin and oil. When absolutely pure and colorless it has but little medicinal action.

MATICO. *U.S.* Matico.

The leaves of *Piper angustifolium* Ruiz et Pavon (nat. ord. *Piperaceæ*).

Matico leaves contain about 2 per cent. of volatile oil, a pungent resin, a crystalline principle, *artanthic acid*, and tannin. Matico is stimulant and hæmostatic.

Official Preparations.

Extractum Matico Fluidum . Fluid Extract of Matico.	Made with a menstruum consisting of 3 parts of alcohol and 1 part of water (see page 414). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).
Tinctura Matico . . . . . . Tincture of Matico.	Made by percolating 100 Gm. of powdered matico with diluted alcohol to make 1000 C.c. (see page 372). Dose, one fluidrachm (3.7 C.c.).

CUBEBA. *U.S.* Cubeb.

The unripe fruit of *Piper Cubeba* Linné filius (nat. ord. *Piperaceæ*).

This useful fruit, or berry as it is commonly called, contains about 10 per cent. of volatile oil, 3 per cent. of resin, cubebin, *cubebic acid*, wax, fat, etc. The virtues of cubeb reside in the cubebic acid, resin, and oil, cubebin when pure being destitute of activity. Cubebic acid, cubebic resin, and cubebin are all colored red by strong sulphuric acid. Cubeb is used as a diuretic, stimulant, and expectorant.

Official Preparations.

Extractum Cubebæ Fluidum . Fluid Extract of Cubeb.	Made with a menstruum of alcohol (see page 403). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).
Oleoresina Cubebæ . . . . . Oleoresin of Cubeb.	Made by percolating cubeb with ether, distilling off, and evaporating the ether (see page 434). The yield is 18 to 25 per cent. Dose, five to fifteen minims (0.3 to 0.9 C.c.).
Trochisci Cubebæ . . . . . Troches of Cubeb.	Each troche contains about ½ grain of oleoresin of cubeb (see Trochisci, Part V.).
Tinctura Cubebæ . . . . . . Tincture of Cubeb.	Made by percolating 200 Gm. of cubeb with sufficient diluted alcohol to make 1000 C.c. (see page 366). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

OLEUM CUBEBÆ. *U.S.* Oil of Cubeb.

A volatile oil distilled from Cubeb.

It is a colorless, or pale greenish, or yellowish liquid, having the characteristic odor of cubeb, a warm, camphoraceous, aromatic taste, and a neutral reaction. Sp. gr. about 0.920. It is soluble in an equal weight of alcohol.

The oil contains a small amount of a hydrocarbon, $C_{10}H_{16}$, boiling at 158°–163° C. (316.4°–325.4° F.), and two oils of the formula $C_{15}H_{24}$, boiling at 262°–265° C. (503.6°–509° F.), one of which unites with

HCl, while the other does not. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearopten. The crystals have the formula $C_{30}H_{48} + 2H_2O$, are fusible at 67°–68° C. (152.6°–154.4° F.), and volatilize without change at 148°–150° C. (298.4°–302° F.). Oil of cubeb is an aromatic stimulant and carminative.

CAPSICUM. *U. S.* **Capsicum.** [CAYENNE PEPPER. AFRICAN PEPPER.]
The fruit of *Capsicum fastigiatum* Blume (Nat. Ord. *Solanaceæ*).

The principal constituents of capsicum are capsaicin, $C_9H_{14}O_2$, traces of a volatile alkaloid and a volatile oil, fixed oil, resin, coloring-matter, etc. *Capsaicin* is in colorless crystals, volatile, intensely acrid, and soluble in alcohol, ether, and fixed oils. Capsicum is stimulant and rubefacient.

Official Preparations.

Emplastrum Capsici . . . . . Capsicum Plaster.	Made by spreading resin plaster upon muslin, cooling, and applying a thin coating of oleoresin of capsicum.
Extractum Capsici Fluidum . Fluid Extract of Capsicum.	Made with alcohol (see page 399). Dose, one-half to one minim (0.03 to 0.06 C.c.).
Oleoresina Capsici . . . . . . Oleoresin of Capsicum.	Made by percolating powdered capsicum with ether, distilling, and evaporating (see page 434). Yield, 5 per cent. Dose, one-fourth to one minim (0.015 to 0.06 C.c.).
Tinctura Capsici . . . . . . Tincture of Capsicum.	Made by percolating 50 Gm. of powdered capsicum with a menstruum of 19 parts of alcohol and 1 part of water until 1000 C.c. are obtained (see page 363). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).

COPAIBA. *U. S.* **Copaiba.** [BALSAM OF COPAIBA.]

The oleoresin of *Copaiba Langsdorffii* (Desfontaines) O. Kuntze, and of other species of *Copaifera* (nat. ord. *Leguminosæ*).

Copaiba is mostly imported from Pará, in Brazil, Maracaibo, in Venezuela, and other South American ports. It contains *copaivic acid*, volatile oil, and a bitter principle. Copaivic acid, $C_{20}H_{30}O_2$, the resinous mass left after distilling the oil, forms a series of amorphous salts. (See Massa Copaibæ.) It may be obtained pure by exposing a mixture of nine parts of copaiba and two parts of aqueous ammonia (sp. gr. 0.95) to a temperature of 10° C. (50° F.). Copaiba is often adulterated.

Copaiba. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A transparent or translucent, more or less viscid liquid, of a color varying from pale yellow to brownish-yellow. Sp. gr. 0.940 to 0.990 at 15° C. (59° F.).	Peculiar aromatic odor; persistently bitter and acrid taste.	Insoluble.	Absolute, Readily soluble.	Soluble in ether, chloroform, carbon disulphide, benzin, and fixed and volatile oils.

Tests for Identity.	Impurities.	Tests for Impurities.
It is not fluorescent, and when heated to 130° C. (266° F.) does not become gelatinous. It yields a transparent mixture with one-third of its volume of ammonia water.	Fixed Oils.	When subject to heat, it does not evolve the odor of turpentine, and, after distilling off the volatile oil, the residue, when cool, should be amorphous, transparent, and friable.
	Gurjun Balsam.	On adding 1 drop of Copaiba to 19 drops of carbon disulphide and shaking the mixture with 1 drop of a cold mixture of equal parts of sulphuric and nitric acids, it should not acquire a purplish-red or violet color.

Uses.—Copaiba is stimulant and diuretic, and has a special irritant action upon the mucous membranes of the urinary passages. Dose, from twenty minims to one fluidrachm (1.2 to 3.7 C.c.).

Official Preparations.

Massa Copaibæ . . . This is a magnesium copaivate, and is made by mixing 6 parts of Mass of Copaiba. magnesia with 94 parts of copaiba: the solidification takes place better if the magnesia be hydrated. Dose, five to ten grains (0.3 to 0.6 Gm.). (See Part V.)

Resina Copaibæ . . The residue left after distilling copaiba (copaivic acid) (see page 461). Resin of Copaiba. Dose, five to ten grains (0.3 to 0.6 Gm.).

OLEUM COPAIBÆ. *U. S.* Oil of Copaiba.

A volatile oil distilled from Copaiba.

It is a colorless or pale yellowish liquid, having the characteristic odor of copaiba, a pungent, bitterish taste, and a neutral reaction. Sp. gr. 0.890 to 0.910. It is soluble in ten times its volume of alcohol, forming a slightly turbid liquid.

This oil is a hydrocarbon, consisting of $C_{10}H_{16}$ and $C_{15}H_{24}$. It is used as a stimulant, and for the same purposes as copaiba. Dose, five to ten minims (0.3 to 0.6 C.c.).

OLEUM SANTALI. *U. S.* Oil of Santal. [Oil of Sandal-Wood.]

A volatile oil distilled from the wood of *Santalum album* Linné (nat. ord. *Santalaceæ*).

It is a pale yellowish or yellow liquid, of a peculiar, strongly aromatic odor, a pungent and spicy taste, and a slightly acid reaction. Sp. gr. 0.970 to 0.978. It is readily soluble in alcohol, and is liable to be grossly adulterated. If to 1 C.c. of the oil at 20° C. (68° F.) there be added 10 C.c. of a mixture of 3 volumes of alcohol and 1 volume of water, a perfectly clear solution should be obtained (test for *cedarwood oil, castor oil,* and *other fatty oils*).

This is an oxygenated oil, consisting of $C_{15}H_{24}O$ and $C_{15}H_{26}O$. It is used as a stimulant to the mucous membranes, especially in the treatment of gonorrhœa. It is generally administered in capsules. Dose, five to fifteen minims (0.3 to 0.9 C.c.).

BUCHU. *U. S.* Buchu.

The leaves of *Barosma betulina* (Thunberg) Bartling et Wendland, and *Barosma crenulata* (Linné) Hooker (nat. ord. *Rutaceæ*).

This drug owes its valuable properties to the presence of a volatile oil and resin: it also contains a bitter principle, mucilage, etc. The stearopten *diosphenol* is colored dark green by ferric chloride. Buchu is used as a diuretic and stimulant.

Official Preparation.

Extractum Buchu Fluidum . Made with a menstruum of alcohol (see page 397). Dose, one Fluid Extract of Buchu. fluidrachm (3.7 C.c.).

SERPENTARIA. *U. S.* Serpentaria. [Virginia Snakeroot.]

The rhizome and roots of *Aristolochia Serpentaria* Linné, and of *Aristolochia reticulata* Nuttall (nat. ord. *Aristolochiaceæ*).

This rhizome, when fresh, contains 1 per cent. of volatile oil, a bitter principle, starch, sugar, etc. It yields its virtues to alcohol and diluted alcohol. It is one of the ingredients in compound tincture of cinchona.

Official Preparations.

Extractum Serpentariæ Fluidum . Made with a menstruum of 4 parts of alcohol and 1 part of water (see page 424). Dose, twenty to thirty minims (1.2 to 1.8 C.c.).
Fluid Extract of Serpentaria.

Tinctura Serpentariæ . . . . . . Made by percolating 100 Gm. of powdered serpentaria with sufficient menstruum (65 alcohol and 35 water) to make 1000 C.c. (see page 378). Dose, one fluidrachm (3.7 C.c.).
Tincture of Serpentaria.

HUMULUS. *U. S.* Hops.

The strobiles of *Humulus Lupulus* Linné (nat. ord. *Urticaceæ*).

Hops owe their sedative virtues to a small quantity of volatile oil; their bitterness is due to the resin and lupulin present.

Official Preparation.

Tinctura Humuli . Made by percolating 200 Gm. of hops with sufficient diluted alcohol to make 1000 C.c. (see page 369). Dose, one fluidrachm (3.7 C.c.).
Tincture of Hops.

LUPULINUM. *U. S.* Lupulin. [LUPULINA, PHARM. 1870.]

The glandular powder separated from the strobiles of *Humulus Lupulus* Linné (nat. ord. *Urticaceæ*).

Lupulin contains 10 per cent. of volatile oil, which, on exposure, yields valerianic acid, trymethylamine, a bitter principle (lupamaric acid), $C_{32}H_{50}O_7$, resin, wax, and an alkaline liquid termed *lupuline*. Alcohol and ether are the best solvents.

Official Preparations.

Extractum Lupulini Fluidum . Made with a menstruum of alcohol (see page 413). Dose, ten to fifteen minims (0.6 to 0.9 C.c.).
Fluid Extract of Lupulin.

Oleoresina Lupulini . . . . . . Made by percolating lupulin with ether, distilling, and evaporating the ether. The yield is about 50 per cent. (see page 435). Dose, three to ten minims (0.18 to 0.6 C.c.).
Oleoresin of Lupulin.

CANNABIS INDICA. *U. S.* Indian Cannabis. [INDIAN HEMP.]

The flowering tops of the female plant of *Cannabis sativa* Linné (nat. ord. *Urticaceæ*), grown in the East Indies.

Indian cannabis contains a resinous substance, *cannabinine*, volatile oil, and tetanocannabinine. Alcohol is the best solvent for the active principles. It is used as an anodyne and nervous stimulant.

Official Preparations.

Extractum Cannabis Indicæ . . . . . Made by percolating Indian cannabis with alcohol, distilling the alcohol from the percolate, and evaporating to a pilular consistence (see page 446). Dose, one-fourth grain to two grains (0.016 to 0.13 Gm.).
Extract of Indian Cannabis.

Extractum Cannabis Indicæ Fluidum . Made with alcohol (see page 398). Dose, one-half to one minim (0.03 to 0.06 C.c.).
Fluid Extract of Indian Cannabis.

Tinctura Cannabis Indicæ . . . . . . Made by percolating 150 Gm. of Indian cannabis with sufficient alcohol to make 1000 C.c. (see page 363). Dose, thirty minims (1.8 C.c.).
Tincture of Indian Cannabis.

VALERIANA. *U. S.* Valerian.

The rhizome and roots of *Valeriana officinalis* Linné (nat. ord. *Valerianeæ*).

Valerian contains about 1 per cent. of volatile oil, valerianic acid, resin, starch, tannin, etc.; there are also present some acetic and formic acids. Alcohol and ether are good solvents for the active principles. It is used as a nervine.

Official Preparations.

Extractum Valerianæ Fluidum . Fluid Extract of Valerian.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 427). Dose, one fluidrachm (3.7 C.c.).
Tinctura Valerianæ . . . . Tincture of Valerian.	Made by percolating 200 Gm. of powdered valerian with a mixture of 3 parts of alcohol and 1 part of water until 1000 C.c. of tincture have been obtained (see page 379). Dose, two fluidrachms (7.4 C.c.).
Tinctura Valerianæ Ammoniata . Ammoniated Tincture of Valerian.	Made by percolating 200 Gm. of powdered valerian with aromatic spirit of ammonia until 1000 C.c. of tincture have been obtained (see page 379). Dose, two fluidrachms (7.4 C.c.).

VIBURNUM OPULUS. *U. S.* Viburnum Opulus. [CRAMP BARK.]

The bark of *Viburnum Opulus* Linné (nat. ord. *Caprifoliaceæ*).

See next article.

Official Preparation.

Extractum Viburni Opuli Fluidum . . . Fluid Extract of Viburnum Opulus.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 428). Dose, one-half to one fluidrachm (1.9 to 3.7 C.c.).

VIBURNUM PRUNIFOLIUM. *U. S.* Black Haw.

[VIBURNUM, PHARM. 1880.]

The bark of *Viburnum prunifolium* Linné (nat. ord. *Caprifoliaceæ*).

Viburnum contains valerianic acid, a bitter, resinous principle, *viburnin*, tannin, sugar, etc. Alcohol is the best solvent for its active principles. It is used like valerian, as a nervine and tonic; it has also diuretic properties.

Official Preparation.

Extractum Viburni Prunifolii Fluidum . Fluid Extract of Viburnum Prunifolium.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 428). Dose, one-half to one fluidrachm (1.9 to 3.7 C.c.).

SAMBUCUS. *U. S.* Sambucus. [ELDER.]

The flowers of *Sambucus canadensis* Linné (nat. ord. *Caprifoliaceæ*).

Elder flowers contain a little volatile oil and resin, sugar, mucilage, etc. Water and diluted alcohol are capable of extracting all the virtues that they possess.

CHENOPODIUM. *U. S.* Chenopodium. [AMERICAN WORMSEED.]

The fruit of *Chenopodium ambrosioides* Linné, and variety *anthelminticum* Gray (nat. ord. *Chenopodiaceæ*).

Chenopodium contains a volatile oil, a small quantity of resin, and bitter extractive. Alcohol and ether are good solvents for its active principles. It is used as an anthelmintic.

OLEUM CHENOPODII. *U. S.* **Oil of Chenopodium.** [OIL OF AMERICAN WORMSEED.]

A volatile oil distilled from Chenopodium.

It is a thin, colorless, or yellowish liquid, of a peculiar aromatic odor, a pungent and bitterish taste, and a neutral reaction. Sp. gr. about 0.970, increasing by age. It is readily soluble in alcohol.

This oil consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion, $C_{10}H_{16}O$. It is used as an anthelmintic. It is best administered as an emulsion, first mixing the oil with twice its volume of olive oil.

OLEUM JUNIPERI. *U. S.* **Oil of Juniper.**

A volatile oil distilled from the fruit of *Juniperus communis* Linné (nat. ord. *Coniferæ*).

It is a colorless or faintly greenish-yellow liquid, becoming darker and thicker by age and exposure to air; having the characteristic odor of juniper, a warm, aromatic, somewhat terebinthinate and sweetish taste, and a neutral reaction. Sp. gr. 0.850 to 0.890. It is soluble in about four times its volume of alcohol, forming a turbid liquid.

Oil of juniper (berries) is a terpene, $C_{10}H_{16}$. It has diuretic and stimulant properties.

Official Preparations.

Spiritus Juniperi . . . . Spirit of Juniper.	Made by mixing 50 C.c. of oil of juniper with 950 C.c. of alcohol (see page 331). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).
Spiritus Juniperi Compositus . Compound Spirit of Juniper.	Made by mixing 8 C.c. of oil of juniper and 1 C.c. each of oils of fennel and caraway with 1400 C.c. of alcohol and sufficient water to make 2000 C.c. (see page 332). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).

SABINA. *U. S.* **Savine.**

The tops of *Juniperus Sabina* Linné (nat. ord. *Coniferæ*).

Savine contains a terpene, $C_{10}H_{16}$, and resin, with a trace of tannin. Alcohol is the best menstruum.

Official Preparation.

Extractum Sabinæ Fluidum . Fluid Extract of Savine.	Made with a menstruum of alcohol (see page 420). Dose, three to eight minims (0.18 to 0.49 C.c.).

OLEUM SABINÆ. *U. S.* **Oil of Savine.**

A volatile oil distilled from Savine.

It is a colorless or yellowish liquid, becoming darker and thicker by age and exposure to air, having a peculiar, terebinthinate odor, a pungent, bitterish, and camphoraceous taste, and a neutral reaction. Sp. gr. 0.910 to 0.940.

This oil is a terpene, $C_{10}H_{16}$. It is used as a stimulant and emmenagogue. Owing to its having been frequently used to produce abortion, it should not be dispensed except upon the order of a physician. Dose, two to five minims (0.12 to 0.3 C.c.).

Unofficial Substances containing Volatile Oil and Resin.

Agaricus Albus. White Agaric.	A fungus from *Polyporus officinalis*, which grows on the trunks of old trees.
Alisma. Water Plantain.	From *Alisma Plantago*, indigenous to Europe. Contains an acrid resin.
Oil of Water Plantain.	A pungent oil.
Aralia Racemosa. American Spikenard.	The rhizome of *A. racemosa*, found in North America. It contains volatile oil, resin, etc.
Cunila. Dittany.	From *C. Mariana*, found in the United States. It contains volatile oil and resin.
Galanga. Galangal.	The rhizome of *Alpinia officinarum*, grown in China. It contains ½ per cent. of volatile oil, and a pungent, soft resin, etc.
Oil of Galangal, $C_{10}H_{18}O$.	A pale yellow or brownish-yellow volatile oil.
Iris Florentina. Florentine Orris.	The rhizome of different species of *Iris*, grown in Europe. It contains a volatile oil, soft, acrid resin, etc.
Juniperus.	The fruit of *J. communis* (nat. ord. *Coniferæ*).
Juniperus Virginiana. Red Cedar.	The tops of *J. virginiana*, grown in Canada and the United States. It contains volatile oil, resin, etc.
Oil of Red Cedar.	Distilled from the wood of *Juniperus virginiana*.
Laserpitium. White Gentian.	From *L. latifolium*, found in Europe. It contains volatile oil and a bitter principle.
Laurocerasus. Cherry Laurel.	From *Prunus Laurocerasus*, found in Western Asia. It contains volatile oil, resin, etc.
Laurus. Laurel.	The leaves and fruit of *L. nobilis*, indigenous to the Levant. It contains volatile and fixed oils, also resin, etc.
Oil of Laurel.	A pale yellow oxygenated oil, sp. gr. 91. The yield is about 2 per cent.
Levisticum. Lovage.	From *L. officinale*, found in Europe. It contains volatile oil, resins, etc.
Liatris. Liatris.	From different species of *Liatris*, indigenous to North America.
Myrica. Bayberry.	The leaves of *M. cerifera*, found near Lake Erie and the Atlantic coast. It contains volatile oil, resin, etc.
Myrtus. Myrtle.	From *M. communis*, found along the Mediterranean. It contains a volatile oil, resin, etc.
Piper Methysticum. Kava-Kava.	The root of *P. Methysticum*, indigenous to the Sandwich Islands. It contains a volatile oil and acrid resin.
Ava-Kava.	An intoxicating liquor, made from the root of *Piper Methysticum*.
Psoralea. Psoralea.	From different species of *Psoralea*, found in the United States. It contains a volatile oil and resin.
Ptelea. Shrubby Trefoil.	From *P. trifoliata*, found in North America. It contains a volatile oil and pungent resin.
Ruta Graveolens. Rue.	The herb of *R. graveolens*.
Oleum Rutæ. Oil of Rue.	A volatile oil from *Ruta graveolens*, sp. gr. 0.880, more soluble in water than most volatile oils. It is methyl-nonyl-ketone, $CH_3.CO.C_9H_{19}$.
Santalum Album. Sandal-wood.	The wood of *S. album*. It contains an oxygenated volatile oil and resin. (See Oleum Santali.)
Thuja. Arbor Vitæ.	The fresh tops of *Thuja occidentalis* Linné (nat. ord. *Coniferæ*).
Wintera. Winter's Bark.	The bark of *Drimys Winteri*, grown in South America.
Oil of Winter's Bark.	The yield of volatile oil is about 1½ per cent.

Official Drugs and Products containing Volatile Oil associated with Bitter Principle or Extractive.

ABSINTHIUM. *U. S.* Absinthium. [WORMWOOD.]

The leaves and tops of *Artemisia Absinthium* Linné (nat. ord. *Compositæ*).

This drug contains 1 per cent. of an oxygenated volatile oil, which is chiefly absinthol, $C_{10}H_{16}O$; the bitter principle is *absinthin*, $C_{40}H_{56}O_9$. It also contains tannin, resin, and succinic acid. It is one of the ingredients in aromatic wine.

TANACETUM. *U.S.* Tansy.

The leaves and tops of *Tanacetum vulgare* Linné (nat. ord. *Compositæ*)

Tansy contains a small quantity of volatile oil, which is freely soluble in alcohol; the bitter principle is *tanacetin*. It also contains tannin, fat, resin, etc.

ARNICÆ FLORES. *U.S.* Arnica Flowers.

The flower-heads of *Arnica montana* Linné (nat. ord. *Compositæ*.)

Arnica flowers contain a trace of volatile oil, and a bitter principle, *arnicin*, with resin, coloring-matter, etc. Alcohol and water extract their virtues.

Official Preparation.

Tinctura Arnicæ Florum . . Tincture of Arnica Flowers.	Made by percolating 200 Gm. of powdered arnica flowers with sufficient diluted alcohol to make 1000 C.c. (see page 360).

ARNICÆ RADIX. *U. S.* Arnica Root.

The rhizome and roots of *Arnica montana* Linné (nat. ord. *Compositæ*).

This rhizome contains about 1 per cent. of volatile oil, the bitter principle *arnicin*, acrid resin, tannin, etc.

Official Preparations.

Extractum Arnicæ Radicis . . . . . . Extract of Arnica Root.	Made by percolating powdered arnica root with diluted alcohol, and evaporating the percolate to a pilular consistence (see page 445). Dose, three to five grains (0.19 to 0.3 Gm.).
Emplastrum Arnicæ . . . . Arnica Plaster.	Made by mixing 330 Gm. of extract of arnica root with 670 Gm. of melted resin plaster. (See Emplastra.)
Extractum Arnicæ Radicis Fluidum . Fluid Extract of Arnica Root.	Made with a menstruum of 3 parts of alcohol to 1 part of water (see page 395). Dose, five to ten minims (0.3 to 0.6 C.c.).
Tinctura Arnicæ Radicis . . . . . . Tincture of Arnica Root.	Made by percolating 100 Gm. of arnica root with sufficient menstruum (650 alcohol, 350 water) to make 1000 C.c. (see page 360). Dose, twenty minims to half a fluidrachm (1.2 to 1.8 C.c.).

CALENDULA. *U. S.* Calendula. [MARIGOLD.]

The florets of *Calendula officinalis* Linné (nat. ord. *Compositæ*).

Calendula contains a small quantity of a volatile oil, a bitter principle, gum, sugar, etc. *Calendulin* is not the active principle, having very little taste.

Official Preparation.

Tinctura Calendulæ . . Tincture of Calendula.	Made by percolating 200 Gm. of powdered calendula with sufficient alcohol to make 1000 C.c. (see page 362). Used externally.

OLEUM ERIGERONTIS. *U. S.* Oil of Erigeron. [OIL OF FLEABANE.]

A volatile oil distilled from the fresh, flowering herb of *Erigeron canadense* Linné (nat. ord. *Compositæ*).

It is a pale yellow liquid, becoming darker and thicker by age and exposure to air, having a peculiar, aromatic, persistent odor, an aromatic, slightly pungent taste, and a neutral reaction. Sp. gr. about 0.850. It is readily soluble in alcohol.

This oil consists of a terpene, $C_{10}H_{16}$, and an oxygenated portion. It is used in uterine hemorrhage as a hæmostatic. It is best administered in capsules.

INULA. *U.S.* Inula. [Elecampane.]

The root of *Inula Helenium* Linné (nat. ord. *Compositæ*).

This root contains acrid resin and a volatile oil, which are the active principles. Helenin, C_6H_8O, is inert. *Inulin*, a kind of starch, is abundant (see page 796). Alcohol and water extract its virtues.

ANTHEMIS. *U.S.* Anthemis. [Chamomile.]

The flower-heads of *Anthemis nobilis* Linné (nat. ord. *Compositæ*), collected from cultivated plants.

Anthemis owes its virtues to a volatile oil, and a bitter principle which has been called *anthemic acid.* The volatile oil is frequently blue in color. It is used as a tonic, often in infusion.

MATRICARIA. *U.S.* Matricaria. [German Chamomile.]

The flower-heads of *Matricaria Chamomilla* Linné (nat. ord. *Compositæ*).

Matricaria contains a dark blue volatile oil, which is soluble in alcohol; the bitter principle is termed *anthemic acid.* It is used as a tonic and stimulant.

EUPATORIUM. *U.S.* Eupatorium. [Thoroughwort.]

The leaves and flowering tops of *Eupatorium perfoliatum* Linné (nat. ord. *Compositæ*).

This plant, known also as *boneset*, contains a volatile oil and resin, *eupatorin*, gum, tannin, sugar, etc. Alcohol, diluted alcohol, and water extract its virtues. It is tonic and laxative.

Official Preparation.

Extractum Eupatorii Fluidum . Fluid Extract of Eupatorium. Made with a menstruum of diluted alcohol (see page 406). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

GRINDELIA. *U. S.* Grindelia.

The leaves and flowering tops of *Grindelia robusta* Nuttall, and of *Grindelia squarrosa* Dunal (nat. ord. *Compositæ*).

Grindelia contains a volatile oil and a bitter and resinous principle. Alcohol is the best menstruum.

Official Preparation.

Extractum Grindeliæ Fluidum . Fluid Extract of Grindelia. Made with alcohol (see page 409). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).

ERIODICTYON. *U. S.* Eriodictyon.

The leaves of *Eriodictyon glutinosum* Bentham (nat. ord. *Hydrophyllaceæ*).

Eriodictyon is known as *Yerba Santa*, or *mountain balm;* it contains a bitter resin, volatile oil, and extractive. It is given in doses of twenty to sixty grains (1.3 to 3.8 Gm.) as a stimulating tonic. Its preparations are often used to disguise the taste of quinine.

Extractum Eriodictyi Fluidum . Fluid Extract of Eriodictyon. Made with a menstruum of 4 parts of alcohol to 1 part of water (see page 405). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).

MEZEREUM. *U. S.* Mezereum.

The bark of *Daphne Mezereum* Linné, and of other species of *Daphne* (nat. ord. *Thymelæaceæ*).

Mezereum contains *daphnin*, $C_{31}H_{34}O_{19}$, a glucoside, associated with an acrid soft resin and oil. Alcohol is the best menstruum for extracting the activity. It is rarely given internally alone, being usually combined with sarsaparilla and other drugs. The dose is five grains (0.3 Gm.).

Official Preparation.

Extractum Mezerei Fluidum . Made with alcohol (see page 414). Dose, one minim (0.06 C.c.).
Fluid Extract of Mezereum. Used externally.

ASPIDIUM. *U. S.* Aspidium. [Male Fern.]

The rhizome of *Dryopteris Filix-mas* Schott, and of *Dryopteris marginalis* Asa Gray (nat. ord. *Filices*).

Aspidium contains *filicic acid*, $C_{14}H_{18}O_5$, filix red, filitannic acid, fixed oil, etc. It is used as a tænifuge in the form of oleoresin. The green portions of the rhizome alone are active.

Official Preparation.

Oleoresina Aspidii . . . Made by exhausting aspidium with ether, distilling, and evaporating (see page 434). Yield, 10 to 15 per cent. Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).
Oleoresin of Aspidium.

CYPRIPEDIUM. *U. S.* Cypripedium. [Ladies' Slipper.]

The rhizome and roots of *Cypripedium pubescens* Swartz, and of *Cypripedium parviflorum* Salisbury (nat. ord. *Orchideæ*).

This rhizome contains resins, an acid principle, volatile oil, tannin, starch, etc. Alcohol extracts its virtues. It is stimulant and diaphoretic, in doses of fifteen grains (0.9 Gm.)

Official Preparation.

Extractum Cypripedii Fluidum . Made with diluted alcohol (see page 403). Dose, fifteen minims (0.9 C.c.).
Fluid Extract of Cypripedium.

PHYTOLACCÆ RADIX. *U. S.* Phytolacca Root. [Poke Root.]

The root of *Phytolacca decandra* Linné (nat. ord. *Phytolaccaceæ*).

This root contains an acrid resin, tannin, mucilage, etc. It is used as an alterative, in doses of twenty grains (1.3 Gm.).

Official Preparation.

Extractum Phytolaccæ Radicis Fluidum . Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 416). Dose, five to thirty minims (0.3 to 1.8 C.c.).
Fluid Extract of Phytolacca Root.

PHYTOLACCÆ FRUCTUS. *U. S.* Phytolacca Fruit. [Poke Berry.]

The fruit of *Phytolacca decandra* Linné (nat. ord. *Phytolaccaceæ*).

This fruit contains reddish-purple coloring-matter, sugar, gum, etc. It is very little used in medicine, although said to be alterative and laxative.

ZEA. *U. S.* Zea. [CORN-SILK.]

The styles and stigmas of *Zea Mays* Linné (nat. ord. *Gramineæ*).

Corn-silk when dried contains *maizenic acid*, fixed oil, resin, chlorophyll, sugar, gum, extractive, etc. It is a mild diuretic, in doses of one to two drachms (3.8 to 7.4 Gm.).

STILLINGIA. *U. S.* Stillingia. [QUEEN'S ROOT.]

The root of *Stillingia sylvatica* Linné (nat. ord. *Euphorbiaceæ*).

Stillingia contains an acrid resin, starch, fixed oil, gum, etc. It is used as an alterative, in doses of twenty grains (1.3 Gm.).

Official Preparation.

Extractum Stillingiæ Fluidum . Made with diluted alcohol (see page 425). Dose, fifteen
Fluid Extract of Stillingia. to forty minims (0.9 to 2.5 C.c.).

PYRETHRUM. *U. S.* Pyrethrum. [PELLITORY.]

The root of *Anacyclus Pyrethrum* (Linné) De Candolle (nat. ord. *Compositæ*)

This root contains an acrid brown resin and fixed oils, inulin, mucilage, etc. It is used as a sialagogue and stimulant, in doses of fifteen to forty grains (0.9 to 2.6 Gm.).

Official Preparation.

Tinctura Pyrethri . . . . Made by percolating 200 Gm. of pyrethrum with sufficient alcohol
Tincture of Pyrethrum. to make 1000 C.c. (see page 375). It is used externally, and in tooth-washes.

XANTHOXYLUM. *U. S.* Xanthoxylum. [PRICKLY ASH.]

The bark of *Xanthoxylum americanum* Miller, and of *Xanthoxylum Clava-Herculis* Linné (nat. ord. *Rutaceæ*).

Xanthoxylum owes its virtues to a soft resin, a crystalline resin, a bitter principle, and an acrid green oil. There are also present sugar, tannin, gum, etc. It is a sialagogue, stimulant, and alterative. Dose, fifteen grains (0.9 Gm.).

Official Preparation.

Extractum Xanthoxyli Fluidum . Made with alcohol (see page 429). Dose, one-half to
Fluid Extract of Xanthoxylum. one fluidrachm (1.8 to 3.7 C.c.).

IRIS. *U. S.* Iris. [BLUE FLAG.]

The rhizome and roots of *Iris versicolor* Linné (nat. ord. *Irideæ*).

The acridity of iris is due to the presence of a bitter resin. There are also present sugar, gum, tannin, and fatty matter. Iris is an alterative and emetic. Dose, fifteen grains (0.9 Gm.).

Official Preparations.

Extractum Iridis Fluidum . Made with a menstruum of alcohol (see page 411). Dose, five
Fluid Extract of Iris. to ten minims (0.3 to 0.6 C.c.).

Extractum Iridis . . . . . Made with a menstruum of alcohol (see page 451). Dose, one
Extract of Iris. to two grains (0.06 to 0.13 Gm.).

CIMICIFUGA. *U. S.* **Cimicifuga.** [BLACK SNAKEROOT.]

The rhizome and roots of *Cimicifuga racemosa* (Linné) Nuttall (nat. ord. *Ranunculaceæ*).

Cimicifuga contains resin, an acrid principle (possibly an alkaloid), starch, tannin, gum, etc. It is used as a sedative and alterative, in doses of thirty grains (1.8 Gm.).

Official Preparations.

Extractum Cimicifugæ . . . . . Extract of Cimicifuga.	Made with a menstruum of alcohol (see page 446). Dose, three to ten grains (0.19 to 0.6 Gm.).
Extractum Cimicifugæ Fluidum . Fluid Extract of Cimicifuga.	Made with a menstruum of alcohol (see page 400). Dose, thirty to sixty minims (1.8 to 3.7 C.c.).
Tinctura Cimicifugæ . . . . . . Tincture of Cimicifuga.	Made by percolating 200 Gm. of cimicifuga with sufficient alcohol to make 1000 C.c. (see page 364). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).

PULSATILLA. *U. S.* **Pulsatilla.**

The herb of *Anemone Pulsatilla* and *Anemone pratensis* Linné (nat. ord. *Ranunculaceæ*), collected soon after flowering.

It should be carefully preserved, and not be kept longer than one year. Pulsatilla contains an acrid, odorous, resinous substance, coloring-matter, gum, etc. The acrid principle may be converted into *anemonin*, $C_{15}H_{12}O_6$, which, through the action of alkalies, becomes anemonic acid. Alcohol is the best menstruum to extract its virtues. It is irritant and diaphoretic, in doses of thirty to fifty grains (1.9 to 3.2 Gm.).

APOCYNUM. *U. S.* **Apocynum.** [CANADIAN HEMP.]

The root of *Apocynum cannabinum* Linné (nat. ord. *Apocynaceæ*).

Apocynum contains resin, *apocynin, apocynein*, bitter extractive, tannin, etc. Alcohol is a good menstruum for it. It is emetic and antiperiodic. Dose, five to twenty grains (0.3 to 1.3 Gm.).

Official Preparation.

Extractum Apocyni Fluidum . Fluid Extract of Apocynum.	Made with a menstruum of 65 parts of alcohol, 25 parts of water, and 10 parts of glycerin (see page 394). Dose, five to twenty minims (0.3 to 1.2 C.c.).

ASCLEPIAS. *U. S.* **Asclepias.** [PLEURISY ROOT.]

The root of *Asclepias tuberosa* Linné (nat. ord. *Asclepiadeæ*).

This root contains resins, volatile principle, tannin, mucilage, etc. Diluted alcohol extracts its virtues. It is used as an expectorant and anodyne, in doses of thirty grains (1.9 Gm.).

Official Preparation.

Extractum Asclepiadis Fluidum . Fluid Extract of Asclepias.	Made with diluted alcohol (see page 395). Dose, twenty minims to one fluidrachm (1.2 to 3.7 C.c.).

LACTUCARIUM. *U. S.* **Lactucarium.**

The concrete milk-juice of *Lactuca virosa* Linné (nat. ord. *Compositæ*).

Lactucarium is a complex substance. It contains a bitter resinous principle, *lactucin*, $C_{11}H_{12}O_3.H_2O$, *lactucic acid* (bitter and crystalline), *lactucopicrin* (bitter and amorphous), *lactucerin* in large quantity, nearly 60 per cent. (this principle is inert and crystallizable), caoutchouc, resin, asparagin, volatile oil, mucilage, etc. It is used as a sedative, in doses of three grains (0.19 Gm.).

Official Preparations.

Tinctura Lactucarii . . Tincture of Lactucarium.	Made by treating 500 Gm. lactucarium with benzin to extract the inert resinous lactucerin, then mixing with sand, and percolating with a mixture of alcohol, water, and glycerin until 1000 C.c. are obtained (see page 371).
Syrupus Lactucarii . . Syrup of Lactucarium.	Made by mixing 100 C.c. of tincture of lactucarium with precipitated calcium phosphate, sugar, and water, dissolving the remainder of the sugar in the filtrate, filtering, and adding enough water to make 1000 C.c. (see page 307). Dose, a fluidrachm (3.7 C.c.).

Unofficial Volatile Oils and Products containing Volatile Oil, Bitter Principle, and Extractive.

Achillea. Yarrow.	A perennial herb of the order Compositæ, *Achillea Millefolium*, growing in America and Europe. It contains achilleine.
Oleum Achilleæ. Oil of Yarrow.	A blue or dark-green volatile oil. The yield is about $\frac{1}{10}$ per cent.
Angustura. Angustura Bark.	The bark of *Galipea Cusparia*, from the mountains near the Orinoco River.
Oil of Angustura, $C_{13}H_{24}O$.	The yield of oil is about $\frac{1}{2}$ per cent.
Apocynum Androsæmifolium. Dogsbane.	A root which grows in New England and Canada.
Artemisia. Mugwort.	From *Artemisia vulgaris*. It contains volatile oil, bitter principle, etc.
Bela. Bael.	From *Ægle Marmelos*, grown in the Himalaya Mountains. It contains tannin, bitter principle, and volatile oil.
Boldus. Boldo.	From *Boldus fragrans*, grown in Chili. It contains volatile oil, glucoside, etc.
Carthamus. American Saffron. Safflower.	Used in infusion. Made in the proportion of two drachms to a pint of boiling water.
Chekan. Cheken.	The leaves of *Eugenia Chekan*, grown in Chili. It contains volatile oil, bitter principle, chekenon, chekenin, chekenetin, and cheken-bitter. Dose of the fluid extract, one to three fluidrachms (3.7 to 11 C.c.).
Clematis. Virgin's Bower.	The herb from different species of *Clematis*.
Coto. Coto Bark.	A bark belonging to the Lauraceæ. It contains cotoin ($C_{22}H_{18}O_6$) and paracotoin.
Oil of Coto Bark.	A pale yellow oil of a peppery taste.
Erigeron. Erigeron.	The leaves and tops of *Erigeron canadense*. Diuretic, tonic, astringent. Dose, in substance, a drachm (3.88 Gm.).
Euphrasia. Eyebright.	*Euphrasia officinalis*, indigenous to Europe.
Genista. Dyers' Broom.	The young branches of *Genista tinctoria*, indigenous to Asia and Europe. It contains a yellowish-green volatile oil.
Geum. Water Avens.	The rhizome of *Geum rivale*, grown in America and Europe. It contains volatile oil and bitter principle.
Gnaphalium. Life-Everlasting.	From different species of *Gnaphalium*, grown in North America. It contains volatile oil and bitter principle.
Helianthemum. Frostwort.	The herb of *Helianthemum canadense*, indigenous to Canada. It contains a bitter principle.
Hypericum. St. John's Wort.	From *Hypericum perforatum*, grown in Europe. It contains hypericum red, volatile oil, etc.
Parthenium. Feverfew.	The flowering herb of *Pyrethrum Parthenium*, growing in waste places in Europe. It contains volatile oil and bitter principle.
Primula. Primrose.	From *Primula officinalis*, indigenous to Europe and Asia. It contains a volatile oil and primulin.
Ranunculus. Crowfoot.	From *Ranunculus bulbosus*, found in North America. It contains a golden-yellow volatile oil and a bitter principle.
Senecio. Groundsel.	From *Senecio aureus*, grown in Europe. It contains bitter principle, etc.
Teucrium. Germander.	From *Teucrium Marum*, indigenous to Europe. It contains volatile oil and bitter principle.
Tilia. Linden Flowers.	From *Tilia americana*. It contains volatile oil, bitter principle, etc.
Trillium. Beth Root.	The rhizome of *Trillium erectum*. It contains resinous, fatty, and acrid principles, etc.
Turnera. Damiana.	The leaves of *Turnera microphylla*. It contains volatile oil, resin, etc.
Verbascum. Mullein.	The flowers of *Verbascum phlomoides*, found in Europe. It contains volatile oil, etc.

QUESTIONS ON CHAPTER LVI.

DRUGS AND PRODUCTS CONTAINING VOLATILE OIL WITH SOFT RESIN.

Pepper—Give the Latin name. What is its synonyme? What does it contain?
How much volatile oil, and what is its composition?
What is its principal use?
What official preparation is made from it?
Piperin—Give the Latin name and formula in symbols. What is piperin?
How is it prepared?
What effect is produced upon it by alkalies in alcoholic solution?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What are its properties, and upon what do its virtues depend?
Matico—Whence is it obtained?
What do the leaves contain? What are its properties?
What official preparations are made from it?
Cubeb—What is the Latin official name? Whence is it obtained?
What does it contain? Upon what do its virtues depend?
Is cubebin active? What effect does strong sulphuric acid have upon cubebic acid, cubebic resin, and cubebin?
What are its medicinal properties?
What official preparations are made from it?
Oil of cubeb—What is the Latin name? What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What are the constituents of this oil?
What is sometimes deposited upon standing?
What are the medicinal properties of the oil?
Capsicum—What is its synonyme? What is capsicum?
What are its principal constituents?
What are the properties of capsaicin?
What are the medicinal properties of capsicum?
What official preparations are made from it?
Copaiba—What is its synonyme? What is copaiba?
Where does it come from? What are its constituents?
What is the composition of copaivic acid?
How may it be obtained pure?
Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Fixed oils; admixture of foreign volatile oil; gurjun balsam.
What is the dose? What official preparations are made from it?
Oil of copaiba—How is it obtained? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
Of what does it consist? What is the dose?
Oil of santal—What is its synonyme? How is it obtained?
What is its specific gravity? Describe odor, taste, chemical reaction, and solubility.
What is its chemical composition? What is the dose?
Broom—What is the Latin name? What is it defined to be?
What are its constituents?
How may its virtues be extracted? What is the dose?
Buchu—Whence derived?
What are its constituents, and to what does it owe its valuable properties?
What stearopten does it contain, and how is this acted upon by ferric chloride?
What are its medicinal properties? Name the official preparations.
Serpentaria—What is its synonyme? What is this defined to be?
What are its constituents? How may its virtues be extracted?
Into what official preparations does it enter?
Hops—What is the Latin name? What are hops?
To what do they owe their virtues? Name the official preparations.
Lupulin—What is the Latin name? What is lupulin?
What are the constituents of lupulin?

What change takes place in the volatile oil on exposure?
What is the bitter principle and its chemical composition?
What are the best solvents for lupulin? Name the official preparations.
Indian cannabis—What is the Latin name? What is its synonyme?
What is its definition? What are its constituents? What is its best solvent?
What are its properties? What are its official preparations?
Valerian—What are its constituents?
What are good solvents for its active principles?
For what is it used? What are its official preparations?
Oil of valerian—Give description, specific gravity, and solubility.
Of what does it consist?
What change is produced by the action of chromic acid?
Does the same change occur in *old* valerian root? Why?
What crystallizable compound is found in the oil?
Viburnum prunifolium—What is its synonyme? What part of the plant is used?
What are its constituents?
What is the best solvent for its active principles?
What are its properties and uses? Name the official preparation.
Viburnum opulus—What is the synonyme?
What is its official preparation?
Elder—Give Latin official name. What do the flowers contain?
What are good solvents?
Chenopodium—What is its synonyme? Whence derived?
What does it contain? What are good solvents?
What is its use?
Oil of chenopodium—What is its synonyme?
Describe odor, taste, chemical reaction, and solubility.
What is its specific gravity?
Of what does it consist? For what and how is it used?
Juniper—Whence is it derived?
To what does it owe its properties?
What other constituents are present?
What is a good solvent? For what is it used?
Oil of juniper—What is its synonyme?
Describe odor, taste, chemical reaction, and solubility.
What is its chemical composition?
What are its medicinal properties?
What are its official preparations?
Savine—What is the Latin name? What is its definition?
What does it contain? What is its best solvent?
What are its official preparations?
Oil of savine—What is the Latin name?
What is its composition? What is the dose? Should it be dispensed cautiously?
Thuja—What is its synonyme? What is its definition?
What are its constituents? What is its best solvent?
What are its medicinal properties?
Absinthium—What is its synonyme? What is its definition?
What are its constituents?
What is the chemical composition of absinthol?
What is the bitter principle, and what is its composition?
Of what official preparation is it an ingredient?
Tansy—What is the Latin name? What is its definition?
What are its constituents? What is the bitter principle?
Arnica flowers—What do these flowers contain?
What is the bitter principle? What are good solvents?
What are its official preparations?
Arnica root—What is its definition?
What does it contain? What are its official preparations?
Calendula—What is its synonyme? What is its definition?
What does it contain? Is calendulin the active principle?
What are the official preparations?
Oil of erigeron—What is the Latin name? What is the synonyme?
Whence is it obtained? What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility.

Of what does it consist? What is its use, and how is it best administered?
Inula—What is its synonyme? Whence is it obtained?
What are its constituents?
Which of these are the active principles? What are good solvents?
Anthemis—What is its synonyme? What is its definition?
To what does it owe its virtues?
What is the name of the bitter principle?
For what and how is it generally used?
What is the color of the volatile oil?
Matricaria—What is its synonyme? Whence is it derived?
What are its constituents? What is the name of the bitter principle?
What are its medicinal properties?
Eupatorium—What is its synonyme? What is its definition?
What are its constituents? What are good solvents?
What are its medicinal properties? What are the official preparations?
Grindelia—What is its definition?
What does it contain? What is its best solvent?
What are its official preparations?
Mezereum—What is its definition?
What does it contain? What is its best solvent?
How is it generally used medicinally? What is the dose?
What are its official preparations?
Aspidium—What is its synonyme? What is its definition?
What are its constituents? For what is it used?
What part of the rhizome is active? What are its official preparations?
Cypripedium—What is its synonyme? What is its definition?
What are its constituents? What is a good solvent?
What is the dose? What are the official preparations?
Phytolacca root—What is the Latin name? What is its synonyme?
Whence is it derived?
What are its constituents? What is the dose?
Phytolacca berry—What does it contain? What are its properties?
Stillingia—What is its synonyme? Whence is it derived? What does it contain?
What is the dose? What are its official preparations?
Magnolia—Whence is it derived? What does it contain?
What is the dose?
Pyrethrum—What is its synonyme? Whence is it derived?
What does it contain? What is the dose? What are the official preparations?
Xanthoxylum—What is its synonyme? Whence is it derived?
What are its constituents, and to what does it owe its virtues?
What is the dose? What are the official preparations?
Iris—What is its synonyme? What is its definition?
What are its constituents?
To what is its acridity due? What is the dose?
What are the official preparations?
Cimicifuga—What is its synonyme? What is its definition?
What does it contain? What is the dose? What are the official preparations?
Pulsatilla—What is its definition?
What does it contain? Into what may the acrid principle be converted, and what does this become through the action of alkalies?
What is its best solvent? What is the dose?
Apocynum—What is the synonyme? Whence is it derived?
What does it contain? What is a good solvent? What is the dose?
Asclepias—What is the synonyme? Whence is it derived?
What does it contain? What is a good solvent? What is the dose?
Lactucarium—What is it? What does it contain?
What is the chemical composition of the bitter resinous principle?
What are the properties of lactucic acid?
What are the properties of lactucopicrin?
What are the properties of lactucerin?
Which of these principles is in the largest proportion?
What is the dose? What are its official preparations?

CHAPTER LVII.

RESINS, OLEORESINS, GUM-RESINS, AND BALSAMS.

RESINS are natural or induced solid or semi-solid exudations from plants, characterized by being insoluble in water, mostly soluble in alcohol, uncrystallizable, and softening or melting at a moderate heat. They are usually the *oxidized terpenes* of plants, and, owing to their insolubility in water, have little taste; they are, chemically, mixed products; some of them are acids, and combine with alkalies, forming soaps, as in the case of common rosin.

Resins, when pure, are usually transparent; when they contain water, they are opaque, and no longer hard and brittle.

Natural Oleoresins are mixtures of oils and resin, generally obtained by incising the trunks of the trees from which they are obtained: as turpentine, copaiba, etc.

Gum-resins are natural mixtures of gum and resin, usually obtained as exudations from plants: as myrrh, asafetida, etc.

Balsams are resinous substances which contain benzoic, cinnamic, or an analogous acid: as balsam of tolu, etc.

The official resins, oleoresins, gum-resins, and balsams will now be considered, followed by a condensed table of unofficial allied products.

TEREBINTHINA. *U. S.* Turpentine.

A concrete oleoresin obtained from *Pinus palustris* Miller, and from other species of *Pinus* (nat. ord. *Coniferæ*).

White turpentine contains abietic anhydride, which may be converted into abietic acid, $C_{44}H_{64}O_5$, a bitter principle, and 25 per cent. of volatile oil. It is used as an ingredient in plasters (see Emplastrum Galbani), and is sometimes administered in pill form. Dose, fifteen to thirty grains (0.9 to 1.9 Gm.).

OLEUM TEREBINTHINÆ. *U. S.* Oil of Turpentine.

A volatile oil distilled from Turpentine.

This important oil has the composition $C_{10}H_{16}$, and, as has been already stated, is the type of the terpenes.

It is a thin, colorless liquid, of a characteristic odor and taste, becoming stronger and less pleasant by age and exposure to air, and of a neutral or faintly acid reaction. Sp. gr. 0.855 to 0.870. It is soluble in three times its volume of alcohol. Bromine and powdered iodine act violently upon it. Brought in contact with a mixture of nitric and sulphuric acids, it takes fire. It is used as a solvent for resins, etc.

Official Preparation.

Linimentum Terebinthinæ. Turpentine Liniment.	Made by mixing 650 Gm. of resin cerate with 350 Gm. of oil of turpentine (see page 341).

OLEUM TEREBINTHINÆ RECTIFICATUM. *U. S.* Rectified Oil of Turpentine.

Oil of Turpentine, a convenient quantity.
Lime Water, a sufficient quantity.

Shake the Oil thoroughly with six times its volume of Lime Water, and introduce the mixture into a copper still connected with a well-cooled condenser. Then distil, until about three-fourths of the Oil have passed over, and separate the clear Oil from the water. Keep the product in well-stoppered bottles, in a cool place, protected from light. Rectified Oil of Turpentine should always be dispensed when Oil of Turpentine is required for internal use. The object of this preparation is merely to provide a purer form of oil for internal use.

TEREBENUM. *U. S.* Terebene.

$C_{10}H_{16} = 135.7.$

A liquid consisting chiefly of Pinene, and containing not more than very small proportions of Terpinene and Dipentene. Terebene should be kept in well-stoppered bottles, in a cool place, protected from light.

Terebene is made by acting on oil of turpentine with sulphuric acid.

Terebenum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A colorless or slightly yellowish, thin liquid. Specific gravity about 0.862 at 15° C. (59° F.). Boils at 156° to 160° C. (312.8° to 320° F.). On exposure to light and air, Terebene gradually becomes resinified, and acquires an acid reaction.	Rather agreeable thyme-like odor; aromatic, somewhat terebinthinate taste.	Slightly soluble.	Soluble in an equal volume.	Soluble in an equal volume of glacial acetic acid or carbon disulphide.

Impurities.	Tests for Impurities.
Acids.	In its chemical properties it resembles oil of turpentine. Terebene should possess its characteristic agreeable odor, and should not redden moistened blue litmus paper,
Unaltered Oil of Turpentine.	And should not have more than a very slight action on polarized light.
More than traces of Resinous Matter.	When evaporated, it should not leave more than a very slight residue.

Uses.—Terebene is a valuable stimulating expectorant, given in capsules or emulsion in doses of twenty to sixty minims (1.2 to 3.7 C.c.) during the day.

TERPINI HYDRAS. *U. S.* Terpin Hydrate.

$C_{10}H_{18}(OH)_2 + H_2O = 189.58.$

The hydrate of the diatomic alcohol Terpin. Terpin hydrate should be kept in well-stoppered bottles.

Terpin hydrate is made by acting on a mixture of oil of turpentine

and alcohol with nitric acid; after standing three or four days the crystals which form are purified by recrystallization.

Terpini Hydras. *U. S.*	Odor and Taste.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, lustrous, rhombic prisms, permanent in the air. Terpin Hydrate melts at 116° to 117° C. (240.8° to 242.6° F.), with the loss of water, and, at the temperature of boiling water, sublimes in fine needles. When heated in a flask adapted for distillation, it first loses water. At 258° C. (496.4° F.) anhydrous terpin distils over without decomposition, soon solidifying to a crystalline, hygroscopic mass, which melts at 102° to 105° C. (215.6° to 221° F.). When strongly heated on platinum foil, it burns with a bright, smoky flame, leaving no residue.	Nearly odorless; slightly aromatic, somewhat bitter taste.	At 15° C. (59° F.), 250 parts. Boiling, 32 parts.	At 15° C. (59° F.), 10 parts. Boiling, 2 parts.	Soluble in 100 parts of ether, 200 parts of chloroform, and 1 part of boiling glacial acetic acid.

Tests for Identity.	Impurity.	Tests for Impurity.
Terpin Hydrate is dissolved by sulphuric acid with an orange-yellow color. If to its hot, aqueous solution a few drops of sulphuric acid be added, the liquid will become turbid and develop a strongly aromatic odor.	Adhering Acid.	Terpin Hydrate should not have the odor of turpentine, and its hot, aqueous solution should not redden blue litmus paper.

Uses.—Terpin hydrate is used in bronchitis, in doses of two or three grains (0.13 to 0.19 Gm.).

RESINA. *U. S.* Resin. [Colophony.]

The residue left after distilling off the volatile oil from Turpentine.

Resin consists of abietic anhydride, which passes into abietic acid when treated with diluted alcohol. It is a transparent, amber-colored substance, hard, brittle, with a glossy and shallow conchoidal fracture, and having a faintly terebinthinate odor and taste. Sp. gr. 1.070 to 1.080. It melts at about 135° C. (275° F.), and is soluble in alcohol, ether, and fixed and volatile oils. It is used to give adhesiveness to plasters, and in cerates and ointments, as in cantharides cerate, and mercurial plaster.

Official Preparations.

Ceratum Resinæ . . . Made by melting together 350 Gm. of resin, 150 Gm. of yellow wax, and 500 Gm. of lard. (See Cerata.)
Resin Cerate.

Emplastrum Resinæ . Made by melting together 140 Gm. of resin, 800 Gm. of lead plaster, and 60 Gm. of yellow wax. (See Emplastra.)
Resin Plaster.

TEREBINTHINA CANADENSIS. *U. S.* Canada Turpentine.

[Canada Balsam. Balsam of Fir.]

A liquid oleoresin obtained from *Abies balsamea* (Linné) Miller (nat. ord. *Coniferæ*).

Canada turpentine contains resin, associated with a terpene, $C_{10}H_{16}$, and a small quantity of a bitter principle. It is a yellowish or faintly

greenish, transparent, viscid liquid, of an agreeable terebinthinate odor, and a bitterish, slightly acrid taste; slowly drying on exposure, and then forming a transparent mass; completely soluble in ether, chloroform, or benzol. It is used principally as an external application and for mounting microscopic objects.

MASTICHE. *U. S.* Mastic.

A concrete resinous exudation from *Pistacia Lentiscus* Linné (nat. ord. *Anacardieæ*).

Mastic contains a resin (mastichic acid, $C_{20}H_{32}O_2$), which is soluble in strong alcohol; also masticin, a resinous principle which is insoluble in alcohol; a small quantity of volatile oil is likewise present. It is used in pills of aloes and mastic to modify the action of the aloes; in the arts it is employed to form a varnish.

PIX BURGUNDICA. *U. S.* Burgundy Pitch.

The prepared, resinous exudation of *Abies excelsa* Poiret (nat. ord. *Coniferæ*).

Burgundy pitch contains resin, a small quantity of a terpene, $C_{10}H_{16}$, and water. It is almost entirely soluble in glacial acetic acid. It is used as a basis for plasters.

Official Preparations.

Emplastrum Picis Burgundicæ . . Burgundy Pitch Plaster.	Made with 800 Gm. of Burgundy pitch, 50 Gm. of olive oil, and 150 Gm. of yellow wax.
Emplastrum Picis Cantharidatum . Cantharidal Pitch Plaster.	Made by melting together 920 Gm. of Burgundy pitch and 80 Gm. of cerate of cantharides.

AMMONIACUM. *U. S.* Ammoniac.

A gum-resin obtained from *Dorema Ammoniacum* Don (nat. ord. *Umbelliferæ*).

Ammoniac is a gum-resin. It contains about 25 per cent. of gum, 70 per cent. of resin, and about 3 per cent. of volatile oil. The resin is remarkable for yielding resorcin when fused with potassa. With water it forms an emulsion. It is partially soluble in acetic acid. It is used as an expectorant and stimulant. Dose, fifteen grains (0.9 Gm.).

Official Preparations.

Emulsum Ammoniaci . . . . Emulsion of Ammoniac.	Made by rubbing 40 Gm. of ammoniac with 1000 C.c. of water (see page 315). Dose, half a fluidounce (14.7 C.c.).
Emplastrum Ammoniaci cum Hydrargyro . Ammoniac Plaster with Mercury.	720 Gm. ammoniac; 180 Gm. mercury; 8 Gm. oleate of mercury; diluted acetic acid, and lead plaster to make 1000 Gm. (See Emplastra.)

ASAFŒTIDA. *U. S.* Asafetida.

A gum-resin obtained from the root of *Ferula fœtida* (Bunge) Regal (nat. ord. *Umbelliferæ*).

This gum-resin contains a sulphurated volatile oil (ferulyl sulphide), about 20 per cent. of gum, and 70 per cent. of resin. The gum is partially soluble in water; the resin is soluble in alcohol, and yields resorcin by treatment with potassa, and umbelliferone by dry distillation. The valuable principles in asafetida are soluble in alcohol; with water

an emulsion may be formed, which possesses its virtues. It is used as an antispasmodic. Dose, ten grains (0.6 Gm.).

Official Preparations.

Emulsum Asafœtidæ . . Emulsion of Asafetida.	Made by rubbing 40 Gm. of asafetida with 1000 C.c. of water (see page 316). Dose, half a fluidounce (14.7 C.c.).
Tinctura Asafœtidæ . . . Tincture of Asafetida.	Made by macerating 200 Gm. of asafetida with 800 C.c. of alcohol, and adding sufficient alcohol to make 1000 C.c. (see page 360).
Pilulæ Asafœtidæ . . . . Pills of Asafetida.	Each pill contains about 3 grains of asafetida and 1 grain of soap.

MYRRHA. *U. S.* Myrrh.

A gum-resin obtained from *Commiphora Myrrha* (Nees) Engler (nat. ord. *Burseraceæ*).

Myrrh is a gum-resin, and contains 3 per cent. of an oxygenated volatile oil, a bitter principle, and about 30 per cent. of gum and 60 per cent. of resin. Alcohol is the best solvent for the oil and resin, which are its active principles. The gum left after macerating myrrh in alcohol may be used for making a good mucilage. Myrrh is stimulant, tonic, and vulnerary. Dose, twenty grains (1.3 Gm.). It is used in compound myrrh mixture, pills, etc. (See Condensed Chart at the end of this part.)

Official Preparation.

Tinctura Myrrhæ . . Tincture of Myrrh.	Made by macerating 200 Gm. of myrrh with alcohol to obtain 1000 C.c. (see page 372). Used externally.

ELASTICA. *U. S.* India-Rubber. [CAOUTCHOUC.]

The prepared milk-juice of various species of *Hevea* (nat. ord. *Euphorbiaceæ*), known in commerce as Para Rubber.

India-rubber was introduced into the U. S. P. 1890. Its solution is used in making mustard-paper. It is soluble in chloroform, carbon disulphide, oil of turpentine, benzin, and benzole. The milky juice of the plants by combination with sulphur furnishes ordinary soft rubber; this, upon heating, becomes hard rubber.

GUAIACI LIGNUM. *U. S.* Guaiacum Wood.

The heart-wood of *Guaiacum officinale* Linné, and of *Guaiacum sanctum* Linné (nat. ord. *Zygophylleæ*).

This wood owes its virtues to resin, which is present usually to the amount of 25 per cent. It is regarded as an alterative, antirheumatic, and diaphoretic. Dose, thirty to sixty grains (1.9 to 3.8 Gm.). It is an ingredient in both the compound decoction and the compound syrup of sarsaparilla.

GUAIACI RESINA. *U. S.* Guaiac.

The resin of the wood of *Guaiacum officinale* Linné (nat. ord. *Zygophylleæ*).

This resin is usually prepared by boiling guaiac chips in salt water: the resinous scum is collected, melted, and strained. It consists of *guaiacic acid* ($C_{12}H_{16}O_6$), *guaiaconic acid* ($C_{19}H_{20}O_5$), *guaiaretic acid* ($C_{20}H_{26}O_4$), beta resin, gum, etc. Alcohol and alkaline solutions are the best solvents for guaiac. A solution of guaiac resin is colored blue by oxidizing agents, due to the presence of guaiaconic acid. Guaiac is one of the ingredients in compound pills of antimony. This resin is antirheumatic, in doses of fifteen grains (0.9 Gm.).

Official Preparations.

Tinctura Guaiaci .... Tincture of Guaiac.	Made by macerating 200 Gm. of guaiac in alcohol, filtering, and adding sufficient alcohol to make 1000 C.c. The official direction to macerate *seven days* is unnecessary; it should be macerated until dissolved; twenty-four hours is often sufficient time (see page 368). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).
Tinctura Guaiaci Ammoniata ... Ammoniated Tincture of Guaiac.	Made by macerating 200 Gm. of guaiac in aromatic spirit of ammonia to obtain 1000 C.c. (see page 369). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

BALSAMUM TOLUTANUM. *U. S.* Balsam of Tolu.

A balsam obtained from *Toluifera Balsamum* Linné (nat. ord. *Leguminosæ*).

Balsam of tolu contains *cinnamic* and *benzoic acids*, resins, a volatile oil called *benzyl benzoate*, $C_7H_5(C_7H_7)O_2$, *benzyl cinnamate*, a terpene, $C_{10}H_{16}$, termed *tolene*, and other, unimportant constituents. It is used as a stimulant and expectorant. Alcohol is the best solvent; it is almost insoluble in benzin. Warm carbon disulphide removes from the balsam scarcely anything but cinnamic and benzoic acids. On evaporating the disulphide, no substance having the properties of resin should remain.

Balsamum Tolutanum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A yellowish-brown, semi-fluid or nearly solid mass, becoming more brittle when exposed to cold, transparent in thin layers. Carbon disulphide, aided by a gentle heat, removes from the Balsam scarcely anything but some of its cinnamic and benzoic acids. On decanting and evaporating the disulphide, no substance having the properties of *resin* should remain.	Agreeable odor, recalling that of vanilla, but distinct from it; mild, aromatic taste; acid reaction.	Nearly insoluble.	Readily and completely soluble in alcohol.	Completely soluble in chloroform; solutions of fixed alkalies; almost completely soluble in ether; nearly insoluble in benzin or carbon disulphide.

Official Preparations.

Tinctura Tolutana . Tincture of Tolu.	Made by dissolving 100 Gm. of balsam of tolu in enough alcohol to make 1000 C.c. (see page 379). Dose, one fluidrachm (3.7 C.c.).
Syrupus Tolutanus . Syrup of Tolu.	Made by making a medicated water from the balsam of tolu with water, dissolving in this the sugar, straining, and making up to 1000 C.c. with water (see page 311).

BALSAMUM PERUVIANUM. *U. S.* Balsam of Peru.

A balsam obtained from *Toluifera Pereiræ* (Royle) Baillon (nat. ord. *Leguminosæ*).

Balsam of Peru contains *cinnamic* and *benzoic acids*, *benzyl cinnamate*, $C_9H_7(C_7H_7)O_2$, resin, *benzyl benzoate*, stilbene, etc.

Balsamum Peruvianum. *U. S.*	Odor and Taste.	Solubility. Alcohol.	Other Solvents.
A liquid having a syrupy consistence, free from stringiness or stickiness, of a brownish-black color in bulk, reddish-brown and transparent in thin layers. On exposure to air it does not become hard. Sp. gr. 1.135 to 1.150.	Somewhat smoky, but agreeable and vanilla-like odor: bitter taste, leaving a persistent after-taste; acid reaction.	5 parts.	Miscible, in all proportions, with absolute alcohol, chloroform, or glacial acetic acid. Partially soluble in ether or benzin.

Test for Identity.	Impurities.	Tests for Impurities.
On distilling water with a portion of the Balsam, no *essential oil* should pass over.	Gurjun Balsam.	If 1 C.c. of carbon disulphide be mixed with 3 C.c. of the Balsam, contained in a dry test-tube, a clear liquid will result. On now adding 8 more C.c. of carbon disulphide and agitating, the resinous constituent of the Balsam (amounting to about 15 per cent.) will adhere to the walls of the tube, and the liquid portion will be clear, of a tint not deeper than light brownish, and not more than faintly fluorescent.
	Fixed Oils.	If 10 drops of the Balsam be triturated, in a small mortar, with 20 drops of sulphuric acid, a tough, homogeneous, brownish-red mass will result, which, when washed with cold water, should, after a few minutes, be converted into a brittle, resinous mass.
	Storax, Turpentine, Copaiba, etc.	If 2 C.c. of the Balsam be vigorously shaken, in a dry test-tube, with 8 C.c. of benzin, so that the Balsam may be spread over the walls of the tube and the liquid then immediately poured off, the Balsam should remain adherent to the walls for some minutes and subside slowly, while the liquid (which should be filtered, if turbid) should be colorless or only faintly yellow, and should deposit no sediment on standing.

Uses.—Balsam of Peru is very apt to be adulterated. It is used as a preservative for fats, ointments, etc.; internally, it is stimulant and aromatic.

BENZOINUM. *U. S.* Benzoin.

A balsamic resin obtained from *Styrax Benzoin* Dryander (nat. ord. *Styraceæ*).

Benzoin contains benzoic acid, cinnamic acid ($C_9H_8O_2$), a fragrant volatile oil, and resins: in some varieties vanillin is found. Alcohol is the best solvent for its active principles. It is a valuable stimulant and expectorant. Dose, thirty grains (1.9 Gm.).

Official Preparations.

Adeps Benzoinatus . . . . Benzoinated Lard.	Made by digesting 20 Gm. of benzoin tied in a piece of coarse muslin in 1000 Gm. of melted lard.
Tinctura Benzoini . . . . Tincture of Benzoin.	Made by macerating 200 Gm. of benzoin in alcohol to obtain 1000 C.c. (see page 361). Dose, thirty minims (1.8 C.c.).
Tinctura Benzoini Composita . . Compound Tincture of Benzoin.	Made by macerating 120 Gm. benzoin, 20 Gm. purified aloes, 80 Gm. storax, and 40 Gm. balsam of tolu in alcohol to obtain 1000 C.c. (see page 362). Dose, thirty minims.

STYRAX. *U. S.* Storax.

A balsam prepared from the inner bark of *Liquidambar orientalis* Miller (nat. ord. *Hamamelaceæ*).

Storax contains cinnamic acid, benzoic acid, *styracin*, $C_9H_7(C_9H_9)O_2$, *storesin*, $C_{36}H_{58}O_3$, *ethyl cinnamate*, $C_9H_7(C_2H_5)O_2$, *phenyl-propyl cinnamate*, $C_9H_7(C_9H_{17})O_2$, *styrol*, C_8H_8, a fragrant hydrocarbon, and a resinous substance not yet investigated. A large quantity of water is usually present. It is insoluble in water, but completely soluble (with the exception of accidental impurities) in an equal weight of warm alcohol. If the alcoholic solution, which has an acid reaction, be cooled, filtered, and evaporated, it should leave not less than 70 per cent. of the original weight of the balsam, in the form of a brown, semi-liquid residue, almost completely soluble in ether and in carbon disulphide, but insoluble in benzin. When heated on a water-bath, Storax becomes more fluid, and if it be then agitated with warm benzin, the supernatant liquid, on being decanted and allowed to cool, will

be colorless, and will deposit white crystals of cinnamic acid and cinnamic ethers. Storax is used in compound tincture of benzoin. It is stimulant and expectorant. It may be used, like benzoin, to protect fatty substances from rancidity.

ACIDUM BENZOICUM. *U. S.* Benzoic Acid.

$HC_7H_5O_2$; 121.71.

Preparation.—Benzoic acid is found naturally in benzoin, balsam of tolu, balsam of Peru, gum acroides, storax, and other resinous substances. It may be obtained from these by the process described on page 171; but, owing to the small yield afforded in this way, commercial benzoic acid is now largely made artificially in several ways:

1. From the urine of cattle, by mixing it with lime in excess, evaporating and decomposing the lime hippurate with hydrochloric acid. The separated hippuric acid, after purification with animal charcoal, is treated with hydrochloric acid, when benzoic acid and *glycocine* are produced, the hydrochloric acid not being decomposed.

$$\underset{\text{Hippuric Acid.}}{C_9H_9NO_3} + \underset{\text{Water.}}{H_2O} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Glycocine.}}{C_2H_5NO_2}.$$

The benzoic acid is sometimes sublimed with benzoin to mask its disagreeable odor and imitate the acid sublimed from benzoin.

2. Benzoic acid is made from *naphtalin*, $C_{10}H_8$, which, on treatment with nitric acid, yields *phthalic acid;* this, when heated with excess of calcium hydrate, yields calcium benzoate and carbonate.

$$\underset{\text{Phthalic Acid.}}{C_8H_6O_4} = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

3. Benzoic acid is also made from trichlormethyl-benzol, a compound obtained from toluol, C_7H_8, a coal-tar hydrocarbon. By heating it with zinc chloride and acetic acid, benzoic acid is formed, hydrochloric acid being liberated at the same time.

Acidum Benzoicum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, or yellowish-white, lustrous scales or friable needles, permanent in air; somewhat volatile at a moderately warm temperature; volatilizes freely with the vapor of water; it begins to sublime at 100° C. (212° F.); it melts at 121.4° C. (250.5° F.), and at a higher temperature it is consumed without leaving a residue. The acid sublimed from benzoin has a lower melting point, and a greater solubility in water. It is rendered darker by exposure to light. If gradually heated in a retort with 3 parts of freshly slaked lime, benzol is evolved.	Slight aromatic odor of benzoin; a warm, acid taste; acid reaction.	Cold, 500 parts. Boiling, 15 parts.	Cold, 2 parts. Boiling, 1 part.	In 3 parts of ether, 7 parts of chloroform, and readily soluble in carbon disulphide, benzol, and fixed or volatile oils, but sparingly soluble in benzin; freely soluble in solutions of potassa, soda, and ammonia.

Test for Identity.	Impurities.	Tests for Impurities.
On carefully neutralizing any of the solutions of benzoic acid in alkaline liquids, and adding ferric chloride T.S., previously diluted with 2 volumes of water, and neutralized by ammonia, if necessary, a flesh-colored precipitate of ferric benzoate is produced.	Readily Carbonizable, Organic Matters.	The solution of the Acid in pure, cold sulphuric acid, when gently warmed, should not turn darker than light brown; if now poured into water, the Benzoic Acid should separate as a white precipitate, and the liquid should be colorless.
	Chlorine.	If 0.5 Gm. of the Acid and 0.8 Gm. of calcium carbonate be mixed with a little water in a crucible, the mixture dried, gently ignited, and then dissolved in water, with the aid of nitric acid in slight excess so as to obtain 20 C.c. of filtrate, the addition of silver nitrate T.S. to the latter should not produce much more opalescence (if at all) than is produced by the same reagent in a solution measuring 20 C.c. prepared by dissolving 0.8 Gm. of the same calcium carbonate in water with the aid of nitric acid.
	Cinnamic Acid.	On warming 0.5 Gm. of the Acid with 5 C.c. of water and 0.5 Gm. of potassium permanganate in a test-tube stoppered loosely and placed in a water-bath heated to about 45° C. (113° F.), then tightly stoppering, and cooling the test-tube with cold water, upon removing the stopper the odor of oil of bitter almond should not be evolved.

Uses.—This acid is useful in forming *benzoates*, a class of salts which have been employed frequently during the last few years. It is stimulant, expectorant, and irritant to the mucous membranes. Dose, ten grains (0.64 Gm.), administered in thick mucilage or syrup.

Unofficial Products from Oils and Substances containing Resins.

Alkanet.	The root of *Anchusa tinctoria*. Used exclusively for coloring oils, ointments, and plasters, which are beautifully reddened by $\frac{1}{16}$ of their weight of the root.
Annatto.	A coloring substance, consisting of the pulp which surrounds the seeds in the fruit of *Bixa Orellana*. Used for coloring cheese and butter, and for dyeing silk and cotton, orange-yellow.
Bdellium. Bdellium.	From *Balsamodendron Mukul*, grown in India. It contains volatile oil and resin.
Benzoyl Glycocoll, $CH_2<^{NH.C_7H_5O}_{COOH.}$	The dose of sodium hippurate is ten grains (0.6 Gm.) three times a day.
Copal.	A resinous substance, brought principally from the East Indies. Used for making varnish.
Doundaké.	An astringent and tonic febrifuge.
Elemi. Elemi.	From *Canarium commune*, grown in the Philippine Islands. It contains 10 per cent. of volatile oil, $C_{10}H_{16}$, and 25 per cent. of resin.
Euphorbium. Euphorbium.	From *Euphorbium resinifera*, found in Morocco. It contains 18 per cent. of gum and 38 per cent. of resin, etc.
Galbanum. Galbanum.	From *Ferula galbaniflua*. It contains 8 per cent. of volatile oil and 85 per cent. of resin. Dose, fifteen grains (0.972 Gm.).
Gurjun. Wood Oil.	From *Dipterocarpus turbinatus*. It contains about 40 per cent. of volatile oil and resin.
Gutta-Percha. Gutta-Percha.	From *Isonandra Gutta*. Its solution in chloroform was formerly official.
Hippuric Acid, ($C_9H_9NO_3$).	Suggested as a remedy in the uric acid diathesis.
Labdanum. Ladanum.	A stimulant expectorant. At present used only in plasters.
Lac. Lacca.	A reddish-brown resin. Formerly used in medicine, but at present chiefly for making varnish; also in making sealing-wax.
Liquidambar. Styraciflua. (Copalm Balsam.)	Stimulant and expectorant. The bark of the tree is astringent, and is used in diarrhœa and dysentery, especially in children, given in the form of a syrup.

Unofficial Products from Oils and Substances containing Resins.—*Continued.*

Olibanum. Frankincense.	From several species of *Boswellia*, found in Africa. It contains 6 per cent. of volatile oil and 56 per cent. of resin.
Pix Canadensis. Canada Pitch.	From *Abies canadensis*. Used in making plasters.
Resina Draconis. Dragon's Blood.	The resin from the fruit of *Calamus Draco*. It contains a peculiar resin, $C_{20}H_{20}O_2$, etc.
Retinol.	A yellowish oil, boiling at 280° C. Mildly antiseptic. Good solvent of phosphorus.
Sagapenum.	Stimulant, antispasmodic. Dose, ten to thirty grains (0.6 to 1.9 Gm.). Used also externally in plasters as a discutient.
Sandarach. Gum Juniper.	Used chiefly as a varnish and as incense. Formerly given internally, and used in ointments and plasters.
Succinum. Amber.	Contains succinic acid, and a volatile oil which is stimulant and antispasmodic, or rubefacient when applied externally.
Terpinol, $(C_{10}H_{16})_2H_2O$.	Derivative of oil of turpentine. In colorless crystals. Dose, three to four grains (0.194 to 0.259 Gm.).
Viscum Album. Mistletoe.	Oxytocic. Dose, a fluidrachm (3.7 C.c.) of the fluid extract.

Eclectic Resinoids.

These so-called active principles are made by adding a concentrated alcoholic fluid extract of the drug to a large quantity of water, and collecting the precipitate: they are largely used by the eclectic practitioners, and vary greatly in properties and effects. *They must not be confounded with true active principles*, although the names are often exactly the same: this fact often leads to annoyance in dispensing, and has been the cause of dangerous mistakes. A list of the *resinoids* most frequently used is appended.

Alnuin.	From the bark of *Alnus rubra*. The dose is about one to three grains (0.065 to 0.194 Gm.).
Ampelopsin.	From the branches and bark of *Ampelopsis quinquefolia*. The dose is from two to eight grains (0.130 to 0.518 Gm.).
Apocynin.	From the root of *Apocynum androsæmifolium*. It yields about one ounce of apocynin from two pounds of drug. The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Asclepidin.	From the root of *Asclepias tuberosa*. The dose is from one to five grains (0.065 to 0.324 Gm.).
Baptisin.	From the root of *Baptisia tinctoria*. It is of a yellowish-brown color. The dose is from one-third to one grain (0.022 to 0.065 Gm.).
Barosmin.	From the leaves of *Barosma betulina* and other species. The dose is from one to four grains (0.065 to 0.259 Gm.).
Caulophyllin.	From the root of *Caulophyllum thalictroides*. It yields about 12 per cent. of caulophyllin. The dose is from one-quarter to one grain (0.016 to 0.065 Gm.).
Ceanothin.	From the root of *Ceanothus americanus*.
Cerasein.	From the bark of *Cerasus virginiana*. The dose is from five to ten grains (0.324 to 0.648 Gm.).
Chelonin.	From the herb of *Chelone glabra*. The dose is from one to two grains (0.065 to 0.130 Gm.).
Chimaphilin.	From the leaves of *Chimaphila umbellata*. The dose is from one to four grains (0.065 to 0.259 Gm.).
Cimicifugin.	From the rhizome of *Cimicifuga racemosa*. It yields about 5 per cent. It is also called Macrotin. The dose is from one to six grains (0.065 to 0.389 Gm.).
Collinsonin.	From the herb of *Collinsonia canadensis*. The dose is about three grains (0.194 Gm.).
Cornin.	From the bark of the root of *Cornus florida*. The dose is about five grains (0.324 Gm.).
Corydalin.	From the tubers of *Dicentra canadensis*. It yields about one-half ounce of corydaline from two pounds of the tubers. The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Cypripedin.	From the rhizome of *Cypripedium pubescens*. The dose is about two grains (0.130 Gm.).
Dioscorein.	From the root of *Dioscorea villosa*. The dose is from two to five grains (0.130 to 0.324 Gm.).
Euonymin.	From the bark of *Euonymus atropurpureus*. The dose is from one-fourth to four grains (0.016 to 0.259 Gm.).

Eclectic Resinoids.—*Continued.*

Eupatorin.	From the leaves and flowering tops of *Eupatorium perfoliatum.* The dose is from two to four grains (0.130 to 0.259 Gm.).
Euphorbin.	From the root of *Euphorbia corollata.* The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Fraserin.	From the root of *Frasera Walteri.* The dose is from one to five grains (0.065 to 0.324 Gm.).
Gelsemin.	From the rhizome of *Gelsemium sempervirens.* The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Hamamelin.	From the root of *Hamamelis virginica.* The dose is about five grains (0.324 Gm.).
Helonin.	From the root of *Helonias dioica.* The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Hydrastin.	From the rhizome of *Hydrastis canadensis.* The dose is from three to five grains (0.194 to 0.324 Gm.).
Juglandin.	From the bark of the root of *Juglans cinerea.* The dose is from two to five grains (0.130 to 0.324 Gm.).
Leptandrin.	From the root of *Leptandra virginica.* The dose is from two to four grains (0.130 to 0.259 Gm.).
Lupulin.	From the strobiles of *Humulus Lupulus.* The dose is from five to ten grains (0.324 to 0.648 Gm.).
Lycopin.	From *Lycopus virginicus.* The dose is from three to five grains (0.194 to 0.324 Gm.).
Macrotin.	See Cimicifugin.
Menispermin.	From *Menispermum canadense.* The dose is about two grains (0.130 Gm.)
Myricin.	From *Myrica cerifera.* The dose is from two to eight grains (0.130 to 0.518 Gm.).
Phytolaccin.	From *Phytolacca decandra.* The dose is from one-quarter to one grain (0.016 to 0.065 Gm.).
Populin.	From the bark of *Populus tremuloides.* The dose is from two to five grains (0.130 to 0.324 Gm.).
Prunin.	From *Cerasus serotina.* The dose is about two grains (0.130 Gm.).
Ptelein.	From the root of *Ptelea trifoliata.*
Rhein.	From different species of *Rheum.* The dose is from two to four grains (0.130 to 0.259 Gm.).
Rhusin.	From the leaves of *Rhus glabra.* It is said to be a light brown powder.
Rumin.	From *Rumex crispus.* The dose is about two grains (0.130 Gm.).
Sanguinarin.	From *Sanguinaria canadensis.* The dose is from one-half to two grains (0.032 to 0.130 Gm.).
Scutellarin.	From the herb of *Scutellaria lateriflora.* The dose is from three to six grains (0.194 to 0.389 Gm.).
Senecin.	From *Senecio gracilis.* The dose is from three to five grains (0.194 to 0.324 Gm.).
Senecionin.	From *Senecio gracilis.* The dose is from one to five grains (0.065 to 0.324 Gm.).
Smilacin.	From different species of *Smilax.* The dose is from two to five grains (0.130 to 0.324 Gm.).
Stillingin.	From *Stillingia sylvatica.* The dose is one-half to one grain (0.032 to 0.065 Gm.).
Trillin.	From *Trillium pendulum.* The dose is from three to six grains (0.194 to 0.389 Gm.).
Viburnin.	From *Viburnum Opulus.* The dose is about two grains (0.130 Gm.).

QUESTIONS ON CHAPTER LVII.

RESINS, OLEORESINS, GUM-RESINS, AND BALSAMS.

What are resins, and how are they characterized? What are they chemically?
What are natural oleoresins? What are gum-resins? What are balsams?
Terebinthina—What is its synonyme? What is its definition?
What does it contain? What is the dose?
Oil of turpentine—What is its synonyme? What is the Latin name?
What is its chemical composition? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What action does a mixture of nitric and sulphuric acids have upon it?
For what substances is it a solvent? What are its officinal preparations?
Resin—What is its synonyme? Whence obtained?
Of what does resin consist?
What change takes place in it when treated with diluted alcohol?
What is its specific gravity?

Describe odor, taste, chemical reaction, solubility, and melting-point.
For what is it used? What are its official preparations?
Canada turpentine—Give Latin official name. What is its synonyme?
What is it? What does it contain?
Describe odor, taste, chemical reaction, and solubility.
For what purposes is it used?
Mastic—What is the Latin name? Whence is it derived?
What does it contain? For what purposes is it used?
Burgundy pitch—What is the Latin name? Whence is it derived?
What does it contain? In what acid is it almost entirely soluble?
For what is it used? What are its official preparations?
Canada pitch—Whence is it derived?
What does it contain? For what is it used? What are its official preparations?
Gutta-percha—Whence is it derived?
Of what does it consist? Describe its solubility.
What are its official preparations?
Ammoniac—What is the Latin official name? What is ammoniac?
What does it contain?
For what is the resin remarkable? Describe its solubility.
What is the dose? What are its official preparations?
Asafetida—What is the Latin official name? What is its definition?
What does it contain?
Chemically considered, what is the volatile oil?
What does the resin yield by treatment with potassa?
What does it yield by dry distillation?
What is the best solvent for its valuable principles?
Will water extract its virtues? How? What is the dose?
What are its official preparations?
Myrrh—Whence is it obtained?
What does it contain? What are its active principles?
What is its best solvent? For what can the gum left after macerating myrrh in alcohol be used? What is the dose? What are its official preparations?
Guaiacum wood—What is the Latin name? What is its definition?
To what does this owe its virtues? How much resin does it usually contain?
What is the dose? Of what official preparations is it an ingredient?
Guaiac—What is the Latin name? How is this resin prepared?
Of what does it consist? What are the best solvents for guaiac?
Why is a solution of guaiac colored blue by oxidizing agents?
What is the dose? What are the official preparations?
Balsam of tolu—What is the Latin name? Whence is it obtained?
What does it contain? What is its best solvent? What portions of it are soluble in carbon disulphide? How may the presence of resin be detected?
What are its medicinal properties? What are its official preparations?
Balsam of Peru—What is the Latin name? Whence is it obtained?
What does it contain?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Gurjun balsam; fixed oils and alcohol. For what purposes is it used?
Benzoin—What is the Latin name? Whence is it obtained?
What does it contain? What is its best solvent?
What is the dose? What are the official preparations?
Storax—What is the Latin name? Whence is it obtained?
What does it contain? Into what preparations does it enter?
What are its medicinal properties? For what is it used?
Benzoic acid—Give formula in symbols, molecular weight, and Latin name.
Where is it found, and how may it be obtained?
How is it prepared artificially from urine? What is the rationale of the process?
How is this acid sometimes treated to disguise its odor?
How is it made from naphtalin? What is the rationale of the process?
How is it made from trichlormethyl-benzol?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Organic impurities; chlorobenzoic acid; cinnamic acid. What is the dose?
What are eclectic resinoids, and how are they usually prepared?
Are they the active principles of the drugs from which they are prepared?

CHAPTER LVIII.

FIXED OILS, FATS, AND SOAPS.

FIXED oils and fats are obtained from both the vegetable and the animal kingdom. They are greasy to the touch, and leave a permanent oily stain on paper; they are insoluble in water, but dissolve in ether, chloroform, carbon disulphide, benzol, benzin, turpentine, and volatile oils; they usually mix with one another without separating.

When pure, they are generally colorless or have a pale yellow color; they have a distinctive odor and taste, which is often caused by impurities with which they are associated, as the process of refining deprives them of odor and taste.

When heated moderately, if solid they melt, or if liquid they become thinner; if heated strongly in air they are decomposed, evolve offensive vapors, and then burn with a sooty flame, much heat being generated. Their specific gravity varies from 0.870 to 0.985, thus being lighter than water. By exposure to air they acquire an acrid, disagreeable taste and become acid to litmus paper. This change, termed *rancidity*, is believed to be due to the presence of impurities (like albuminous substances), which act as ferments, induce decomposition, liberate the fatty acids, and produce volatile, odorous acids, like caproic, caprylic, butyric, and valerianic acids. Oils which have become rancid may often be purified by shaking them thoroughly with hot water and then with a cold solution of sodium carbonate, and subsequently washing them with cold water.

Chemically, the fixed oils and fats are compound ethers of higher members of the fatty acids, the alcohol being glycerin and the radical glyceryl. In most cases they consist of two or three proximate principles,—olein, palmitin, or stearin. These are sometimes termed the glycerides of oleic, palmitic, and stearic acids. Olein is liquid, and palmitin and stearin are both solid: hence the consistence of fixed oils and fats is due to the relative proportion of these principles: thus, almond oil, being composed principally of olein, is always liquid at ordinary temperatures, whilst tallow, being largely stearin, is solid.

Olein, $C_3H_5(C_{18}H_{33}O_2)_3$, is the oleate of the triad radical glyceryl, and constitutes the liquid principle of oils. It is extremely difficult to obtain it pure. Being in most oils associated with the solids stearin and palmitin, it has to be separated by pressure and other mechanical means, and this is not easily effected. As ordinarily procured, therefore, olein contains more or less of palmitin or stearin, or both. It is obtained either by the agency of alcohol or by expression. When one of the oils, olive oil, for example, is dissolved in boiling alcohol, the solution, on cooling, deposits the concrete principles, retaining the olein, which it yields upon evaporation. The other method consists in compressing one of the solid fats, or of the liquid oils rendered concrete by cold, between folds of bibulous paper, which absorb the olein, and give it up after-

wards by compression under water. Olein is a liquid of oily consistence, congealing at —6° C. (21.2° F.), colorless when pure, with little odor and a sweetish taste, insoluble in water, soluble in boiling alcohol and ether.

Palmitin.—Palmitic acid occurs in the more liquid fats, such as palm oil and coco-nut oil, as glyceride; while in spermaceti and some forms of wax it is combined with monatomic alcohol radicals. Palmitin is the *glyceride of palmitic acid* or *tripalmitate of glyceryl.*

Stearin.—This exists abundantly in tallow and other animal fats, and it is made on an immense scale for use in candles by cooling lard and tallow, and separating the olein by hydraulic pressure. It may be obtained pure by dissolving suet in hot oil of turpentine, allowing the solution to cool, submitting the solid matter to expression in unsized paper, repeating the treatment several times, and finally dissolving in hot ether, which deposits the stearin on cooling. This is white, opaque in mass, but of a pearly appearance as crystallized from ether, pulverizable, fusible at 66.5° C. (152° F.), soluble in boiling alcohol and ether, but nearly insoluble in those liquids cold, and quite insoluble in water. It consists of glyceryl and stearic acid, as a glyceride, $C_3H_5(C_{18}H_{35}O_2)_3$, and has been formed synthetically by heating a mixture of these two materials to 280°–300° C.

Margarin.—What was long known under this name was shown by Heintz, in 1852, to be a mixture of stearin and palmitin. The true *margaric acid*, $C_{17}H_{34}O_2$, has been obtained by synthesis, and according to Ebert is found in *adipocere*, a waxy substance formed in the tissues of dead animals.

Stearic acid, $C_{18}H_{36}O_2$, is a firm white solid, like wax, fusible at 69.2° C. (157° F.), greasy to the touch, pulverizable, soluble in alcohol, very soluble in ether, but insoluble in water. In the impure state it is used as a substitute for wax in making wax candles. (See Acidum Stearicum). *Palmitic acid*, $C_{16}H_{32}O_2$, forms a white scaly mass, and melts at 62° C. (143.6° F.). *Oleic acid*, $C_{18}H_{34}O_2$, is an oily liquid, insoluble in water, soluble in alcohol and ether, lighter than water, crystallizable in needles a little below 0° C. (32° F.), and having a slight smell and a pungent taste. (See Acidum Oleicum.) *Glycerin* is described under a separate head. (See Glycerina.)

AMYGDALA DULCIS. *U.S.* Sweet Almond.

The seed of *Prunus Amygdalus* var. *dulcis* De Candolle (nat. ord. *Rosaceæ*).

Sweet almond contains about 40 per cent. of fixed oils, protein compounds (*conglutin* and *amandin*), sugar, mucilage, etc. Tannin is present in the integuments.

The protein compounds aid in emulsionizing the fixed oil which is present, and simple trituration is all that is necessary to form a mixture.

Official Preparations.

Emulsum Amygdalæ . . Emulsion of Almond. Made by blanching 60 Gm. of sweet almond, adding 10 Gm. of acacia and 30 Gm. of sugar, and triturating with 1000 C.c. of distilled water (see page 316). Dose, two to eight fluidounces (59 to 236 C.c.).

Syrupus Amygdalæ . . Syrup of Almond. Made from 140 Gm. of sweet almond, 40 Gm. of bitter almond, 200 Gm. of sugar, 100 C.c. of orange flower water, and water and syrup to make 1000 C.c. (see page 302). Dose, one to two fluidounces (29 to 59 C.c.).

OLEUM AMYGDALÆ EXPRESSUM. *U. S.* Expressed Oil of Almond.

A fixed oil expressed from Bitter or Sweet Almond.

Preparation.—This oil is obtained equally pure from sweet and bitter almonds. The almonds, having been deprived of a reddish-brown powder adhering to their surface, by being rubbed together in a piece of coarse linen, are ground in a mill, and then pressed in canvas sacks between plates of steel slightly heated. The oil, which is at first turbid, is clarified by rest and filtration. Sweet almond yields about 40 per cent. and bitter almond 35 per cent. of fixed oil.

A colorless oil may be obtained by expressing almonds which have been *blanched*,—*i.e.*, deprived of their testa by soaking them in hot water and slightly pressing them, and afterwards drying in a stove to evaporate the water.

Oleum Amygdalæ Expressum. *U. S.*	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvents.
A clear, pale straw-colored, or colorless, oily liquid. Sp. gr. 0.915 to 0.920 at 15° C. (59° F.). It remains clear at —10° C. (14° F.), and does not congeal until cooled to near —20° C. (—4° F.).	Almost inodorous; mild, nutty taste.	Slightly.	In all proportions in ether and chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
If 10 C.c. of the Oil be mixed with 15 C.c. of a 15-per-cent. solution of sodium hydrate and 10 C.c. of alcohol, the mixture allowed to stand at a temperature of 35° to 40° C. (95° to 104° F.), with occasional agitation, until it becomes clear, and then be diluted with 100 C.c. of water, the clear solution thus obtained, upon the subsequent addition of an excess of hydrochloric acid, will set free a layer of oleic acid. This, when separated from the aqueous liquid, washed with warm water, and clarified in a water-bath, will remain liquid at 15° C. (59° F.), although sometimes depositing particles of solid matter and becoming turbid.	Fixed Oils of Apricot and Peach Kernels, and Sesamum, Cotton Seed, and Poppy Seed Oils.	If 2 C.c. of the Oil be vigorously shaken with 1 C.c. of fuming nitric acid and 1 C.c. of water, a whitish, not red or brownish, mixture should be formed, which, after standing for some hours at about 10° C. (50° F.), should separate into a solid, white mass, and a scarcely colored liquid.
	Olive, Arachis, Cotton Seed, Sesamum, and other Fixed Oils.	One part of this oleic acid, when mixed with 1 volume of alcohol, should give a clear solution, which at 15° C. (59° F.) should not deposit any fatty acids, nor become turbid on the further addition of 1 volume of alcohol.

Uses.—Expressed oil of almond, or *oil of sweet almonds*, as it is usually called, is used as an emollient, and an ingredient in "cold cream" and phosphorated oil.

OLEUM OLIVÆ. *U. S.* Olive Oil.

A fixed oil expressed from the ripe fruit of *Olea europæa* Linné (nat. ord. *Oleaceæ*).

Preparation.—Although pure olive oil is still found occasionally, there is good reason to believe that the so-called olive oil is mainly cotton seed oil, or other similar substitution, judiciously flavored. Pure

olive oil is made by expressing olives and clarifying the oil by subsidence; but the detection of admixtures of other fixed oils is attended with discouraging results. The exportation of over six million gallons of cotton seed oil annually to Mediterranean ports contiguous to the olive oil industry is a significant fact. The Pharmacopœia furnishes the following tests. It is difficult to detect an admixture of a similar vegetable oil of less than 20 per cent. by any published test.

Oleum Olivæ. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A pale yellow, or light greenish-yellow, oily liquid. When cooled to about 10° C. (50° F.), it begins to be somewhat cloudy from the separation of crystalline particles, and at 0° C. (32° F.) it forms a whitish, granular mass. Sp. gr. 0.915 to 0.918 at 15° C. (59° F.).	Slight, peculiar odor; nutty, oleaginous taste, with a faintly acrid after-taste; neutral reaction.	Very sparingly soluble.	Readily soluble in ether, chloroform, and carbon disulphide.

Tests.	Impurities.	Tests for Impurities.
If 10 C.c. of the Oil be shaken frequently, during two hours, with a freshly prepared solution of 1 Gm. of mercury in 3 C.c. of nitric acid, a perfectly solid mass of a pale straw color will be obtained. If 30 C.c. of the Oil be saponified by heating with 20 C.c. of alcohol and 5 Gm. of potassa, the liquid then diluted with 200 C.c. of water, and freed from alcohol by boiling, on supersaturating the solution with diluted sulphuric acid the fatty acids will form a layer on the surface. If these be separated as far as possible, free from water, and filtered, 5 C.c. of the clear filtrate, when shaken in a test-tube with 5 C.c. of concentrated hydrochloric acid, should not color the latter green, and, on the subsequent addition of about 0.5 Gm. of sugar, and again shaking the mixture, no violet or crimson tint should be produced in the acid layer within fifteen minutes (absence of *sesamum oil*).	Appreciable quantities of Cotton Seed Oil and most other Seed Oils.	If 6 Gm. of the Oil be thoroughly shaken, in a test-tube, for about two minutes, with a mixture of 1.5 Gm. of nitric acid and 0.5 Gm. of water, then heated in a bath of boiling water for not more than fifteen minutes, the Oil should retain a light yellow color, not becoming orange or reddish-brown, and, after standing at the ordinary temperature for about twelve hours, it should form a perfectly solid, light yellowish mass.
	More than 5 per cent. of Cotton Seed Oil and many other Foreign Oils.	If 5 C.c. of the Oil be thoroughly shaken, in a test-tube, with 5 C.c. of an alcoholic solution of silver nitrate (prepared by dissolving 0.1 Gm. of silver nitrate in 10 C.c. of deodorized alcohol, and adding 2 drops of nitric acid), and the mixture heated for about five minutes in a water-bath, the Oil should retain its original pale yellow color, not becoming reddish or brown, nor should any dark color be produced at the line of contact of the two liquids.

Uses.—Olive oil is used in making cerates, ointments, liniments, and plasters. It is a bland, agreeable oil, well suited for emollient purposes.

OLEUM GOSSYPII SEMINIS. *U. S.* Cotton Seed Oil.

A fixed oil expressed from the seed of *Gossypium herbaceum* Linné, and of other species of *Gossypium* (nat. ord. *Malvaceæ*), and subsequently purified.

Preparation.—This oil is made commercially in the southern part of the United States upon a very large scale. The seeds contain 15 per cent. of oil.

The testa of the seeds is first separated, and the kernels are exposed to powerful expression in hydraulic presses.

Oleum Gossypii Seminis. *U. S.*	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvents.
A pale yellow, oily liquid. Specific gravity 0.920 to 0.930 at 15° C. (59° F.). On cooling the Oil to a temperature below 12° C. (53.6° F.), particles of solid fat will separate. At about 0° to —5° C. (32° to 23° F.), the Oil solidifies.	Odorless; bland, nut-like taste.	Very sparingly.	Readily soluble in ether, chloroform, or carbon disulphide.

Tests for Identity.
When the Oil is brought in contact with concentrated sulphuric acid, a dark reddish-brown color is instantly produced.
If 6 Gm. of the Oil be thoroughly shaken, in a test-tube, for about two minutes, with a mixture of 1.5 Gm. of nitric acid and 0.5 Gm. of water, then heated in a bath of boiling water for not more than fifteen minutes, the Oil will assume an orange or reddish-brown color, and, after standing for twelve hours at the ordinary temperature, will form a semi-solid mass.
If 5 C.c. of the Oil be thoroughly shaken in a test-tube, with 5 C.c. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 C.c. of deodorized alcohol and adding 2 drops of nitric acid), and the mixture heated for about five minutes in a water-bath, the Oil will assume a red or reddish-brown color.

OLEUM SESAMI. *U. S.* Oil of Sesamum.

[Sesame Oil. Teel Oil. Benné Oil.]

A fixed oil expressed from the seed of *Sesamum indicum* Linné (nat. ord. *Pedaliaceæ*).

This oil consists of olein (70 per cent.), palmitin, stearin, and myristicin. It is inodorous, of a bland, sweetish taste and a neutral reaction, and will keep long without becoming rancid. It is not a drying oil. At 15° C. (59° F.) it has the sp. gr. 0.919 to 0.923; and its point of congelation is —5° C. (23° F.). Concentrated sulphuric acid converts it into a brownish-red jelly. If 5 C.c. of the oil be shaken with an equal volume of concentrated hydrochloric acid, the latter will usually assume a bright emerald-green color, especially if the oil has been exposed for some time to the action of air and light; and, on the subsequent addition of about 0.5 Gm. of sugar, and again shaking the mixture, a blue color, changing to violet, and finally to deep crimson, will be produced.

OLEUM LINI. *U. S.* Linseed Oil. [Oil of Flaxseed.]

A fixed oil expressed from Linseed without the use of heat.

Preparation.—It will be noticed that the official description specifies an oil made without the use of heat: this would reject all the oil made on the large scale for use in the arts.

Linseed oil is a drying oil, and consists mainly of *linolein*, which, by exposure, becomes *linoxyn*, $C_{32}H_{54}O_{11}$; *myristin* and *palmitin* are also present.

Oleum Lini. *U. S.*	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvents.
A yellowish or yellow, oily liquid. When exposed to the air it gradually thickens, and acquires a strong odor and taste; and if spread, in a thin layer, on a glass plate and allowed to stand in a warm place, it is gradually converted into a hard, transparent, resin-like mass (absence of non-drying oils). Specific gravity, 0.930 to 0.940 at 15° C. (59° F.). It does not congeal above —20° C. (—4° F.).	A slight, peculiar odor and a bland taste.	Absolute, 10 parts.	In all proportions in ether, chloroform, benzin, carbon disulphide, or oil of turpentine.

Tests for Identity.	Impurities.	Tests for Impurities.
It should not more than slightly redden blue litmus paper, previously moistened with alcohol (limit of *free acid*).	Non-Drying Oils.	If 2 C.c. of the Oil be shaken with 1 C.c. of fuming nitric acid and 1 C.c. of water, it should neither completely nor partially solidify, even after standing for one or two days.
If 10 C.c. of the Oil, contained in a small flask, be mixed with a solution of 3 Gm. of potassium hydrate in 5 C.c. of water, then 5 C.c. of alcohol added, and the mixture heated for about five minutes on a water-bath, with occasional agitation, a dark-colored but clear and complete solution should be obtained.	Paraffin Oils.	If the dark-colored, clear solution be diluted with water to the measure of 50 C.c., then cooled and shaken with 50 C.c. of ether, the clear, ethereal layer, after having separated, should not show a bluish fluorescence, and, when carefully decanted, and allowed to evaporate spontaneously, should leave not more than a slight, and not oily, residue.

Uses.—Linseed oil is used as a laxative, in doses of one to two fluidounces (29 to 58 C.c.).

PEPO. *U. S.* Pumpkin Seed.

The seed of *Cucurbita Pepo* Linné (nat. ord. *Cucurbitaceæ*).

This seed contains about 40 per cent. of fixed oil, starch, protein compounds, a little acrid resin, sugar, etc. Pumpkin seed is used as a tænifuge by beating the kernels with water so as to make a mixture like almond mixture: a more elegant method, however, is to emulsify the fixed oil, which is now an article of commerce, and made by percolating the ground seeds with ether.

OLEUM RICINI. *U. S.* Castor Oil.

A fixed oil expressed from the seed of *Ricinus communis* Linné (nat. ord. *Euphorbiaceæ*).

Preparation.—Castor oil has been obtained from the seed in four ways: 1. By cold expression. 2. By expression with heat. 3. By percolation with alcohol. 4. By decoction. The first method produces the best oil: a powerful hydraulic press (see page 251) is generally used, and the oil clarified by subsidence. It is an almost colorless, transparent, viscid liquid, of a faint, mild odor, a bland, afterwards slightly acrid and generally offensive taste, and a neutral reaction. Sp. gr. 0.950 to 0.970. It is soluble in an equal volume of alcohol, and, in all proportions, in absolute alcohol, or in glacial acetic acid; also soluble, at

15° C. (59° F.), in 3 times its volume of a mixture of 19 volumes of alcohol and 1 volume of water (absence of more than about 5 per cent. of *most other fixed oils*). With an equal volume of benzin, it forms, at 15° C. (59° F.), a turbid mixture, but at 17° C. (62.6° F.) it yields a clear solution. When exposed to the air in a thin layer, it slowly dries to a varnish-like film. When cooled to 0° C. (32° F.), it becomes turbid, with the separation of crystalline flakes, and at about —18° C. (—0.4° F.) it congeals to a yellowish mass. If 3 C.c. of the Oil be shaken for a few minutes with 3 C.c. of carbon disulphide and 1 C.c. of sulphuric acid, the mixture should not acquire a blackish-brown color (absence of *many foreign oils*). It contains *ricinolein* and palmitin. The purgative action is due to the presence of an acrid principle, which has not yet been isolated: a given weight of the seeds is more active than the same quantity of oil. Castor oil is used as a purgative, in doses of one-half to one fluidounce (14.5 to 29 C.c.).

OLEUM TIGLII. *U.S.* Croton Oil.

A fixed oil expressed from the seed of *Croton Tiglium* Linné (nat. ord. *Euphorbiaceæ*).

Preparation.—Croton oil is prepared by expression or by percolating the ground seeds with carbon disulphide and distilling the percolate. It is a pale yellow or brownish-yellow, somewhat viscid and slightly fluorescent liquid, having a slight fatty odor, a mild, oily, afterwards acrid, burning taste, and a slightly acid reaction. When applied to the skin, it produces rubefaction or a pustular eruption. Sp. gr. 0.940 to 0.960 at 15° C. (59° F.). It reddens blue litmus paper moistened with alcohol. When fresh, it is soluble in about 60 parts of alcohol, the solubility increasing by age. It is freely soluble in ether, chloroform, carbon disulphide, and fixed or volatile oils. When gently heated with twice its volume of absolute alcohol, it forms a clear solution, from which the Oil usually separates on cooling. If to 2 C.c. of the Oil 1 C.c. of fuming nitric acid and 1 C.c. of water be added, and the mixture vigorously shaken, it should not solidify, either completely or partially, after standing for one or two days (absence of other *non-drying oils*). Neither the purgative principle nor the vesicating principle has been isolated: by the decomposition of the fatty substances present, tiglinic, valerianic, formic, acetic, myristic, stearic, isobutyric, lauric, and palmitic acids have been detected; crotonol, $C_{18}H_{28}O_4$, is said to be present. Internally, in doses of one minim (0.06 C.c.), croton oil is a powerful purgative; externally, when applied to the skin, it is rubefacient and vesicant.

OLEUM THEOBROMATIS. *U.S.* Oil of Theobroma.

[Oleum Theobromæ, Pharm. 1880. Butter of Cacao.]

A fixed oil expressed from the seed of *Theobroma Cacao* Linné (nat. ord. *Sterculiaceæ*).

Preparation.—This is made by expressing the kernels of the "chocolate nut" between hot iron plates, and running the product into moulds. The yield is about 40 per cent. It is a yellowish-white solid, having a faint, agreeable odor, a bland, chocolate-like taste, and a neutral reaction.

Sp. gr. 0.970 to 0.980 at 15° C. (59° F.). Readily soluble in ether or chloroform; also soluble in 100 parts of cold and in 20 parts of boiling absolute alcohol, all these solutions being neutral to litmus paper. It is brittle at 15° C. (59° F.), and melts at 30° to 33° C. (86° to 91.4° F.) to a clear liquid. If 1 Gm. of Oil of Theobroma be dissolved in 3 C.c. of ether, in a test-tube, at a temperature of 17° C. (63° F.), and the tube subsequently plunged into water at 0° C. (32° F.), the liquid should not become turbid, nor deposit a granular mass in less than three minutes; and if the mixture, after congealing, be exposed to a temperature of 15° C. (59° F.), it should gradually form a perfectly clear liquid (absence of *paraffin*, *wax*, *stearin*, *tallow*, etc.).

Chemically, it is a mixture of stearin, palmitin, olein, arachin, and laurin, and, owing to its low fusing-point, and its property of becoming solid at a temperature just below the fusing-point, it is valuable in pharmacy in making suppositories. (See Suppositoria.)

LYCOPODIUM. *U.S.* Lycopodium.

The spores of *Lycopodium clavatum* Linné, and of other species of *Lycopodium* (nat. ord. *Lycopodiaceæ*).

Lycopodium contains 47 per cent. of fixed oil, with minute quantities of volatile bases. It is used as a dusting powder and to allay irritation of the skin through chafing, and for similar purposes.

Oils, and Substances containing Unofficial Fixed Oils.

Oil of Bassia.	From *Bassia longifolia*. Nat. Ord. Sapotaceæ. A greenish oil is expressed from the seeds.
Bayberry.	From *Myrica cerifera*. Nat. Ord. Myricaceæ. Habitat, North America. The oil and wax are prepared by boiling the fruit with water until the oil collects on the surface. The yield of oil is about 30 per cent.
Beech.	From the fruit of *Fagus sylvatica*. Nat. Ord. Cupuliferæ. Habitat, Europe. It is of a yellow color and mild odor and taste. The yield of oil is about 20 per cent.
Behen.	From the fruit of *Moringa aptera*. Used in ointments and pomades.
Ben.	A fixed oil from the seeds of *Moringa pterygosperma*. Used for the same purposes as olive oil.
Black Mustard.	From the seed of *Brassica nigra* (Linné) Koch. Nat. Ord. Cruciferæ. Habitat, Europe. A yellow or brownish-yellow fixed oil. Sp. gr. 0.916. The yield of oil is about 20 per cent.
Brazil Nut.	From the seed of *Bertholletia excelsa*. Nat. Ord. Lecythidaceæ. Habitat, Brazil. It is a pale yellow, bland oil. The yield of oil is about 50 per cent.
Candle Nut.	From *Aleurites triloba*. Habitat, islands of the Pacific Ocean. The yield of oil is about 60 per cent.
Cardamom.	From the fruit of *Elettaria repens*. Nat. Ord. Scitamineæ. The yield of oil is about 10 per cent.
Chaulmugra.	From the seed of *Gynocardia odorata*. Nat. Ord. Bixaceæ. Habitat, Malayan Peninsula. Prepared by subjecting the seeds to pressure and collecting the oil.
Coco-nut.	From *Cocos nucifera*. Nat. Ord. Palmæ. Habitat, tropical countries. Prepared by boiling the seeds with water and expressing. It is of a butyraceous consistence, white, and has a peculiar odor and a bland taste.
Crab.	From *Carapa guianensis*. Prepared by expressing the seed.
Cucumber Seed.	From the seed of *Cucumis sativus*. Nat Ord. Cucurbitaceæ. Habitat, Central Asia.
Ergot.	From *Claviceps purpurea*. The yield of oil is about 25 per cent.
Ground-nut.	From the kernels of the fruit of *Arachis hypogæa*. Prepared by expression.
Hazel-nut.	From *Corylus avellana*. Nat. Ord. Cupuliferæ. Habitat, Europe. The yield of oil is about 50 per cent.
Hemp Seed.	From the seed of *Cannabis sativa*. Nat. Ord. Urticaceæ. Habitat, Europe and North America. The yield of oil is about 30 per cent.
Horsechestnut.	From the kernels of the fruit of *Æsculus Hippocastanum*. Nat. Ord. Sapindaceæ. The yield of oil is about $\frac{1}{10}$ per cent.

Oils, and Substances containing Unofficial Fixed Oils.—*Continued.*

Oil of Hydrastis.	From *Hydrastis canadensis*. Nat. Ord. Ranunculaceæ. Habitat, United States.
Hyoscyamus Seed.	From the seed of *Hyoscyamus niger*. Nat. Ord. Solanaceæ. Habitat, Europe. The yield of oil is about 25 per cent.
Juglans.	From *Juglans cinerea*. Nat. Ord. Juglandaceæ. Habitat, United States. The yield of oil is about 15 per cent.
Kurung.	From *Pongamia glabra*. Nat. Ord. Leguminosæ. Habitat, India. It is a thickish, yellow oil, of sp. gr. 0.945.
Larkspur Seed.	From the seed of *Delphinium Consolida*. Nat. Ord. Ranunculaceæ. Habitat, Central Europe.
Laurel.	From *Laurus nobilis*. Nat. Ord. Lauraceæ. Habitat, Europe. Prepared by steeping the fruit in hot water and expressing.
Mace.	From the arillus of the fruit of *Myristica fragrans*. Nat. Ord. Myristicaceæ. Habitat, Molucca Islands.
Madia.	From *Madia sativa*. Nat. Ord. Compositæ. Habitat, Europe. The yield of oil is about 40 per cent.
Mangosteen.	From *Garcinia indica*. Nat. Ord. Guttiferæ. Habitat, India. The yield of oil is about 30 per cent.
Melon Seed.	From *Cucumis Melo*. Nat. Ord. Cucurbitaceæ. Habitat, Central Asia.
Nicker Seed	From *Cæsalpinia Bunducella*. Nat. Ord. Leguminosæ.
Nigella.	From the seed of *Nigella sativa*. Nat. Ord. Ranunculaceæ. Habitat, Southern Europe. The yield of oil is about 35 per cent.
Niger Seed	From *Guizotia oleifera*. Nat. Ord. Compositæ. Habitat, India. The yield of oil is about 40 per cent.
Nutmeg.	From the kernel of the seed of *Myristica fragrans*. Nat. Ord. Myristicaceæ. Habitat, Molucca Islands. The yield of oil is about 22 per cent.
Palm.	From the fruit of *Elais guineensis*. Nat. Ord. Palmæ. Habitat, West Africa. Sp. gr. 0.945.
Peach.	From *Persica vulgaris*. Nat. Ord. Rosaceæ. The oil resembles expressed oil of almond.
Poppy Seed.	From the seed of *Papaver somniferum*. Nat. Ord. Papaveraceæ. Habitat, Asia and Europe. It is of a yellow color, bland, and limpid. The yield is about 45 to 50 per cent.
Pumpkin Seed.	From the seed of *Cucurbita Pepo*. Nat. Ord. Cucurbitaceæ. Habitat, Asia and Europe. The yield of oil is about 45 per cent.
Purging Nut.	From the seed of *Curcas purgans*. Nat. Ord. Euphorbiaceæ. Habitat, West Indies. The yield is about 35 per cent.
Rape Seed.	From *Brassica campestris*. A fixed oil used for making green soft soap.
Staphisagria.	From the seed of *Delphinium Staphisagria*. Nat. Ord. Ranunculaceæ. Habitat, Europe. The yield of oil is about 30 per cent.
Stramonium Seed.	From the seed of *Datura Stramonium*. Nat. Ord. Solanaceæ. Habitat, United States. The yield of oil is about 25 per cent.
Tonka.	From the seed of *Dipterix odorata*. Nat. Ord. Leguminosæ. Habitat, Guiana. An odorous fixed oil.
Tonka Bean.	Contains coumarin. Used for flavoring. Narcotic. Used in whooping-cough, in doses of five to eight grains (0.3 to 0.5 Gm.), given in the form of fluid extract.
Tucom.	From the fruit of *Astrocaryum vulgare*. Habitat, South America. It has a bright red color and an agreeable odor.
Watermelon Seed.	From the seed of *Cucurbita Citrullus*. Nat. Ord. Cucurbitaceæ. Habitat, Southern Asia. The yield is about 30 per cent.
White Mustard.	From the seed of *Sinapis alba*. Nat. Ord. Cruciferæ. Habitat, Asia. The yield of oil is about 20 per cent.

ACIDUM OLEICUM. *U. S.* Oleic Acid.

$$HC_{18}H_{33}O_2 = 281.38.$$

An organic acid, prepared in a sufficiently pure condition by cooling commercial Oleic Acid to about 5° C. (41° F.), then separating and preserving the liquid portion.

Preparation.—Oleic acid is generally obtained as a by-product in the manufacture of candles from fats, stearic and palmitic acids being the fatty substances sought for by the makers. The crude oleic acid is known as "red oil," the stearic and palmitic acids being separated by cooling the mixture and filtering.

Acidum Oleicum. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A yellowish, oily liquid, gradually becoming brown, rancid, and acid when exposed to the air. Sp. gr. 0.900. At 14° C. (57.2° F.) it becomes semi-solid, and remains so until cooled to 4° C. (39° F.), at which temperature it becomes a whitish mass of crystals. When heated to a temperature of about 95° C. (203° F.), the Acid begins to be decomposed, giving off acrid vapors; at a higher temperature it is completely dissipated.	Lard-like odor and taste; when pure, of a neutral reaction; feebly acid reaction in alcoholic solution.	Insoluble.	Completely soluble.	Completely soluble in chloroform, benzol, benzin, oil of turpentine, and fixed and volatile oils.

Impurities.	Tests for Impurities.
More than traces of Palmitic and Stearic Acids.	If 1 Gm. of the Acid be heated with 20 C.c. of alcohol, 2 drops of phenolphtalein T.S. added, and then a strong solution (1 in 4) of sodium hydrate, drop by drop, until the liquid has acquired a permanent red tint and the Acid is saponified; next acetic acid added until the red color of the liquid is just discharged, and the liquid filtered,—10 C.c. of the filtrate mixed with 10 C.c. of ether should not be rendered more than slightly turbid by the addition of 1 C.c. of lead acetate T.S.
Fixed Oils.	Equal volumes of the Acid and of alcohol, mixed at the ordinary temperature, should give a clear solution without separating oily drops upon the surface.

Uses.—Oleic acid is used as the basis for the oleates, three of which —oleates of mercury, veratrine, and zinc—are official (see page 341). The oleates are very useful external remedies; they are used in various skin diseases, and also for communicating the constitutional effects of numerous remedies. Oleic acid is more quickly absorbed by the skin than any other similar base.

Unofficial Oleates.

Aluminum Oleate, $Al_2(C_{18}H_{33}O_2)_6$.	By decomposing sodium oleate with aluminum sulphate. It is a semi-solid, of a dark brown color, and has a decidedly astringent action. Used in treating burns, scalds, foul ulcers, etc.
Silver Oleate, $AgC_{18}H_{33}O_2$.	By precipitating sodium oleate with a saturated solution of silver nitrate, washing the precipitate with boiling water, drying it, and reducing to a fine powder. It is of a brownish-yellow color. Used externally.
Arsenic Oleate, $As(C_{18}H_{33}O_2)_3$.	By first preparing arsenious chloride by treating metallic arsenic with hydrochloric acid, and then adding sodium oleate and collecting the precipitate. It is of a yellowish color, and has the consistence of butter.
Bismuth Oleate, $Bi(C_{18}H_{33}O_2)_3$.	By dissolving *crystallized* bismuth nitrate in glycerin, then diluting sodium oleate with water and adding the bismuth solution to the sodium mixture, warming, rejecting the aqueous layer, and, lastly, washing several times with warm water. It is of a white or a yellowish-white color, and has about the consistence of an ointment.
Copper Oleate, $Cu(C_{18}H_{33}O_2)_2$.	By adding sodium oleate to a saturated solution of copper sulphate, then washing the precipitate. It is a handsome, dark green, waxy solid. Used chiefly in the treatment for ringworm.
Iron Oleate (Ferric), $Fe_2(C_{18}H_{33}O_2)_6$.	By adding sodium oleate to a solution of ferrous sulphate and *boiling*. It is a dark red, soft, solid oleate. Used locally.
Manganese Oleate.	By adding to a solution of sodium oleate a solution of manganese sulphate, heating gently, and collecting the precipitate. It is of a light gray, slightly pinkish color, having a peculiar odor.
Mercury and Morphine Oleate.	By combining with a gentle heat 40 parts mercuric oleate, 3 parts morphine, and 13 parts oleic acid. It forms a very dark brown, soft solid.
Nickel Oleate.	By adding sodium oleate to a solution of nickel sulphate and collecting the precipitate. It is a green, amorphous, waxy substance. Used locally as an astringent.

Unofficial Oleates.—*Continued.*

Lead Oleate, $Pb(C_{18}H_{33}O_2)_2$.	By adding a *clear* solution of lead acetate to a solution of sodium oleate, boiling and washing the precipitate several times. It has the appearance of lead plaster (somewhat lighter in color).
Sodium Oleate.	By dissolving 1 part of pure Castile soap in 8 parts of hot water, cooling, and filtering from deposited sodium palmitate: the filtrate contains sodium oleate.
Tin Oleate.	By adding a solution of tin chloride to a solution of sodium oleate and collecting the precipitate. It has a grayish-yellow color, a soft consistence, and a decided metallic taste.

ACIDUM STEARICUM. *U. S.* Stearic Acid.

$$HC_{18}H_{35}O_2 = 283.38.$$

An organic acid, in its commercial, more or less impure form, usually obtained from the more solid fats, chiefly tallow.

This has been introduced in the U. S. P. 1890 solely because of its usefulness in making glycerin suppositories. It is a hard, white, somewhat glossy solid, odorless and tasteless, and permanent in the air. Insoluble in water; soluble in about 45 parts of alcohol at 15° C. (59° F.); readily soluble in boiling alcohol, and in ether. Stearic Acid, when pure, melts at 69.2° C. (156.6° F.). The commercial acid should have a melting point not lower than 56° C. (132.8° F.), and the melted acid should not become opaque and begin to congeal at a temperature lower than 54° C. (129.2° F.). If 1 Gm. of Stearic Acid and 1 Gm. of sodium carbonate be boiled with 30 C.c. of water, in a capacious flask, the resulting solution, while hot, should not be more than opalescent (limit of *undecomposed fat*).

Uses.—See Suppositoria Glycerini, Part VI.

GLYCERINUM. *U. S.* Glycerin.

A liquid obtained by the decomposition of vegetable or animal fats or fixed oils, and containing not less than 95 per cent. of absolute Glycerin [$C_3H_5(OH)_3$; 91.79].

Preparation.—This valuable liquid has been made in several ways. It is usually obtained—1. Through the saponification of fats and oils in making soap or lead plaster. 2. By the decomposition of fats and oils through pressure and superheated steam. Glycerin came into use in medicine and pharmacy about 1846, and it was first obtained on a commercial scale from the washings of lead plaster by Robert Shoemaker, of Philadelphia. In making the plaster, litharge, olive oil, and water are boiled together, when the olein of the oil is decomposed by the lead oxide, according to the following reaction:

$$\underset{\substack{\text{Glyceryl Oleate}\\\text{(Olive Oil).}}}{2(C_3H_5 3C_{18}H_{33}O_2)} + \underset{\substack{\text{Lead}\\\text{Oxide.}}}{3PbO} + \underset{\text{Water.}}{3H_2O} = \underset{\substack{\text{Lead Oleate (Lead}\\\text{Plaster).}}}{3(Pb2C_{18}H_{33}O_2)} + \underset{\substack{\text{Glyceryl Hydrate}\\\text{(Glycerin).}}}{2(C_3H_5 3HO)}.$$

The plaster, while still hot and in the liquid state, contains glycerin diffused through it. When the liquid plaster is mixed with an equal measure of boiling water, and the mixture stirred briskly, a solution of glycerin is obtained, which, after having been decanted, and evaporated to a limited extent, is freed from lead by hydrosulphuric acid. The liquid is then filtered to separate lead sulphide, heated to free it from hydrosulphuric acid, and finally evaporated to expel the water.

The process most frequently used for making glycerin originated with R. A. Tilghman, of this city, and consists in subjecting fatty bodies to the action of water at a high temperature under pressure, whereby the fats, which are *glycerides* or ethers of the fatty acids, are broken up into glycerin and fatty acids, the water supplying the elements of hydrogen and oxygen necessary for that change. The reaction is as follows in the case of a fat like stearin:

$$\underset{\text{Stearin.}}{C_3H_53C_{18}H_{35}O_2} + \underset{\text{Water.}}{3H_2O} = \underset{\text{Glycerin.}}{C_3H_53HO} + \underset{\text{Stearic Acid.}}{3HC_{18}H_{35}O_2}.$$

Glycerinum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A clear, colorless liquid, of syrupy consistence, oily to the touch. When exposed to the air it slowly abstracts moisture. Its sp. gr. should not be less than 1.250 at 15° C. (59° F.).	Odorless; very sweet and slightly warm to the taste; neutral action.	In all proportions.	In all proportions.	Soluble in a mixture of 3 parts of alcohol and 1 part of ether; insoluble in ether, chloroform, benzol, fixed oils, volatile oils, carbon disulphide, and benzin.

Tests for Identity.	Impurities.	Tests for Impurities.
In solution with water it is slowly vaporized, with steam, at 100° C. (212° F.); exposed alone to higher temperature, it yields acrid decomposition products of a characteristic odor, and at 165° C. (329° F.) it boils and is decomposed. If a fused bead of borax, on a loop of platinum wire, be moistened with Glycerin and held in the non-luminous flame, the latter will be transiently tinted deep green.	Sugars and Dextrin, which leave a porous coal.	A small portion of Glycerin, when heated in a small, open porcelain or platinum capsule, upon a sand-bath, until it boils, and then gently ignited, should burn and vaporize so as to leave not more than a dark stain.
	Sugars.	If 5 C.c. of Glycerin be mixed with 50 C.c. of water and 10 drops of hydrochloric acid, in a small flask, and heated for half an hour on a boiling water-bath, then 10 C.c. of the hot liquid mixed with 2 C.c. of sodium hydrate T.S. and 1 C.c. of alkaline cupric tartrate V.S., no yellowish-red cloudiness or precipitate should appear within six hours.
	Fixed Impurities.	After full combustion of Glycerin no residue should be left.
	Metals, Sulphuric or Oxalic Acid, or Calcium Salts.	If Glycerin is diluted with 10 times its volume of distilled water, portions should give no precipitates or colors when treated with hydrogen sulphide or ammonium sulphide T.S., barium chloride T.S., calcium chloride T.S., or ammonium oxalate T.S.
	Readily Carbonizable Impurities.	On gently warming a mixture of equal volumes of Glycerin and of concentrated sulphuric acid, in a test-tube, the liquid should not acquire a dark color.
	Fatty Acids, etc.	On gradually heating 5 C.c. of Glycerin with 3 C.c. of diluted sulphuric acid, in a test-tube, short of boiling, no offensive or acidulous odor should be evolved.
	Chlorides, and Impurities having Reducing Properties.	If a mixture of 2 C.c. of Glycerin with 10 C.c. of water, contained in a perfectly clean, glass-stoppered cylinder, be heated for five minutes in a water-bath at a temperature of 60°–65° C. (140°–149° F.), then mixed with 10 drops of silver nitrate T.S., and the cylinder set aside, well stoppered, in diffused daylight, no change of transparency or color should occur in the mixture within five minutes.

Chemically, glycerin belongs to the class of alcohols, and is sometimes termed *glycerol*, or *glyceric alcohol*. It is the hydrate of the radical glyceryl C_3H_5, is triatomic, and one, two, or three of the hydrogen atoms may be replaced by monad radicals. When glycerin is acted on by nitric acid, *nitro-glycerin*, a powerful explosive, is formed. This has been used medicinally in small doses. It is sometimes called *glonoin* and *trinitrine*. (See Spiritus Glonoini.)

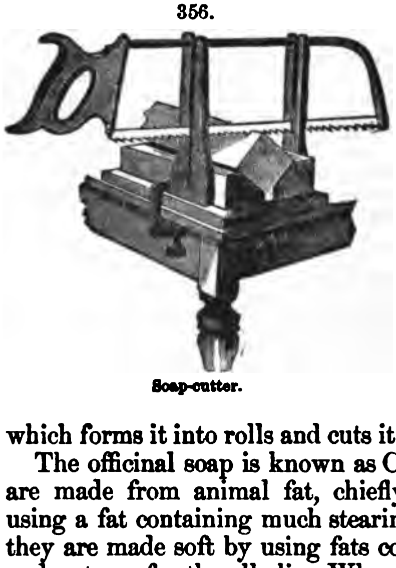
Uses.—Glycerin is one of the most valuable liquids known to pharmacy. It is a solvent and antiseptic, scarcely inferior to alcohol. It is useful in keeping substances moist, owing to its tendency to absorb water from the air. Its agreeable taste and non-poisonous properties adapt it for many purposes. Its varied uses have been constantly referred to in the preceding pages.

SAPO. *U. S.* Soap. [White Castile Soap.]

Soap prepared from soda and olive oil.

Preparation.—Soap is made by boiling fats or oils with a solution of caustic alkali until a thick mass is formed. Then, by evaporating the water, or by adding solution of common salt, the soap is separated and caused to rise to the surface: when it has ceased to froth in boiling, it is ladled out into wooden frames to congeal, after which it is cut into bars by means of a wire. The soap, as first separated, is called *grain soap*. Fig. 356 shows a useful soap-cutter made by the Woodward Lock Company, Clinton, Wisconsin. The "soap-dust" and chippings from Castile soap are a very convenient form for use in making soap liniment, etc. Toilet soap is made by *milling* grain soap, or cutting it into small pieces; perfume is then added, thoroughly mixed, and the mixture forced by a plotting-machine through an aperture, which forms it into rolls and cuts it into pieces. These are then moulded.

356.



Soap-cutter.

The officinal soap is known as Castile soap. The soaps in general use are made from animal fat, chiefly tallow. Soaps are made hard by using a fat containing much stearin, like tallow, and soda for the alkali; they are made soft by using fats containing a large proportion of olein, and potassa for the alkali. When fats and oils undergo *saponification* by reaction with a salifiable base, the olein, palmitin, and stearin present are decomposed into stearic, palmitic, and oleic acids, which unite with the base to form the soap, and into glycerin, which is set free.

Soaps are divided into two classes, soluble and insoluble. The soluble soaps are combinations of the fatty acids with soda, potassa, and ammonia; those which are insoluble consist of the same acids united with earths and metallic oxides. The soluble soaps only are detergent, and to these the name *soap* is usually applied. Several of the insolu-

ble soaps are employed in pharmacy: as, for example, the soap of lead monoxide (litharge), or lead plaster, and the soap of lime, or lime liniment. (See Emplastrum Plumbi and Linimentum Calcis.) The two official soaps are of the soluble kind. One is a soda soap, made with olive oil (Castile soap), the other a potassa soap (Sapo Viridis). The soap of ammonia is noticed elsewhere. (See Linimentum Ammoniæ.)

Sapo. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white or whitish solid, hard, yet easily cut when fresh.	Slight, peculiar odor, free from rancidity; disagreeable, alkaline taste; alkaline reaction.	Readily soluble.	Readily soluble.
		More readily with the aid of heat.	

Impurities.	Tests for Impurities.
An undue amount of Water.	On placing a small, weighed portion of Soap, together with about 10 C.c. of alcohol, in a tared beaker containing sand, evaporating the resulting solution of the Soap to dryness, and drying the residue at 110° C. (230° F.), the loss of weight should not exceed 36 per cent.
Metals.	The aqueous solution of Soap should remain unaffected on the addition of hydrogen sulphide or ammonium sulphide T.S.
Alkalinity.	If a solution of 5 Gm. of Soap in 50 C.c. of water be mixed with 3 C.c. of decinormal oxalic acid V.S., the subsequent addition of a few drops of phenolphtalein T.S. should produce no pink or red tint.
Sodium Carbonate, etc.	On dissolving 20 Gm. of Soap in alcohol, with the aid of heat, transferring the undissolved residue, if any, to a filter, and washing it thoroughly with boiling alcohol, it should, after drying, weigh not more than 0.6 Gm.
Silica and other Accidental Impurities.	And at least 0.4 Gm. of the residue should be soluble in water.
Animal Fats.	A hot four-per-cent. alcoholic solution of soap should not gelatinize on cooling.

Uses.—Soap is a laxative and antacid; it is used in pill masses, in combination with resins, to render them soluble and to modify their harsh action. It is also used in liniments, plasters, cerates, etc.

Official Preparations.

Emplastrum Saponis . . Made by rubbing 100 Gm. of powdered soap with water until semi-
Soap Plaster. liquid, and then incorporating with 900 Gm. of melted lead plaster. (See Emplastra.)

Linimentum Saponis . . Dissolve 45 Gm. of camphor in 750 C.c. of alcohol, then add 70 Gm.
Soap Liniment. of powdered soap and 10 C.c. of oil of rosemary, shake well, and add sufficient water to make 1000 C.c. (see page 340).

SAPO MOLLIS. *U. S.* Soft Soap.

[Sapo Viridis, Pharm. 1880. Green Soap.]

	Metric.	Old form.
Linseed Oil	400 Gm.	40 oz. av.
Potassa	90 Gm.	9 oz. av.
Alcohol	40 C.c.	4 fl. oz.

Water, a sufficient quantity.

Heat the Linseed Oil in a deep, capacious vessel, on a water-bath or steam-bath, to a temperature of about 60° C. (140° F.). Dissolve the

Potassa in 450 C.c. [old form 3 pints] of Water, add the Alcohol, and then gradually add the mixture, constantly stirring, to the Oil, continuing the heat until a small portion of the mixture is found to be soluble in boiling Water without the separation of oily drops. Then allow the mixture to cool, and transfer it to suitable vessels.

The Potassa used in this process should be of the full strength directed by the Pharmacopœia (90 per cent.). Potassa of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken, the proper amount for the above formula being ascertained by dividing 8100 by the percentage of absolute Potassa (potassium hydrate) contained therein.

This is a soft soap, and is generally imported from Germany: it is made from various oils which contain but little stearin. It is a soft, unctuous mass, of a yellowish-brown or brownish-yellow color. It is soluble in about 5 parts of hot water to a nearly clear liquid; also in 2 parts of hot alcohol without leaving more than 3 per cent. of insoluble residue.

Uses.—Green soap is used in skin diseases, chiefly in eczema.

Official Preparation.

Linimentum Saponis Mollis . Liniment of Soft Soap.	Made by dissolving 650 Gm. of soft soap and 20 C.c. of oil of lavender flowers in sufficient alcohol to make 1000 C.c. (see page 241). Used externally.

Unsaponifiable Fats and Petroleum Products.

Under this head will be found two official products which cannot be classed properly with either the fixed or the volatile oils, yet which in some respects partake of the properties of both. Petrolatum, paraffin, and benzin are products from petroleum, and are hydrocarbons belonging to the marsh-gas series.

PETROLATUM LIQUIDUM. *U.S.* Liquid Petrolatum.

A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired consistence.

Liquid Petrolatum is a purified residual liquid obtained in distilling petroleum (see *Petrolatum Molle*).

Petrolatum Liquidum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A colorless, or more or less yellowish, oily, transparent liquid, giving off, when heated, a faint odor of petroleum. Specific gravity about 0.875 to 0.945 at 15° C. (59° F.). When heated on platinum, Liquid Petrolatum is completely volatilized without emitting any acrid vapors.	Odorless and tasteless; neutral reaction.	Insoluble.	Cold, Scarcely. Hot, Scarcely.	Readily in ether, chloroform, carbon disulphide, oil of turpentine, benzin, benzol, and fixed and volatile oils.

Test.	Impurity.	Test for Impurity.
If 2 volumes of concentrated sulphuric acid be added to 1 volume of Liquid Petrolatum, in a test-tube placed in hot water, and the contents occasionally agitated during fifteen minutes, the acid should not acquire a deeper tint than brown, nor lose its transparency (limit of *readily carbonizable organic impurities*).	Fixed Oils or Fats of Animal or Vegetable Origin, or Resin.	If 5 Gm. of Liquid Petrolatum be digested, for half an hour, with 5 Gm. of sodium hydrate and 25 C.c. of water, and the aqueous layer separated, and supersaturated with sulphuric acid, no oily substance should separate.

Uses.—Liquid petrolatum is used as a basis for medicinal unctuous preparations.

PETROLATUM MOLLE. *U. S.* Soft Petrolatum.

[Petrolatum, Pharm. 1880. Soft Petroleum Ointment.]

A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired melting point. When Petrolatum is prescribed or ordered without further specification, Soft Petrolatum (*Petrolatum Molle*) is to be dispensed.

Preparation.—The "residuums," as they are termed technically, which are obtained in the distillation of petroleum, are purified by first melting and then percolating them through recently burned bone-black; this abstracts the odor and the color. The consistency is varied by mixing them with certain portions of the harder paraffins and stirring them until a homogeneous mixture is made.

It is a fat-like mass, of about the consistence of an ointment, varying from white to yellowish or yellow, more or less fluorescent when yellow, especially after being melted, transparent in thin layers, completely amorphous, and without odor or taste, or giving off, when heated, a faint odor of petroleum. If a portion of Soft Petrolatum be liquefied, and brought to a temperature of 60° C. (140° F.), it will have a specific gravity of about 0.820 to 0.840. The melting point of Soft Petrolatum ranges between about 40° and 45° C. (104° and 113° F.). In other respects Soft Petrolatum has the characteristics of, and should respond to the tests given under, Liquid Petrolatum (see *Petrolatum Liquidum*).

Uses.—Petrolatum is used as a basis for ointments, for which it is well adapted. It is known commercially as *cosmoline*, *vaseline*, *petrolina*, *deodorolina*, etc.

PETROLATUM SPISSUM. *U. S.* Hard Petrolatum.

[Petrolatum, Pharm. 1880. Hard Petroleum Ointment.]

A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired melting point.

Hard petroleum has been introduced into the U. S. P. 1890 with a view of furnishing a petroleum of firmer consistence than can be had in liquid or soft petroleum. It is a fat-like mass, of about the consistence of a cerate, varying from white to yellowish or yellow, more or less fluorescent when yellow, especially after being melted, transparent in thin layers, completely amorphous, and without odor or taste,

or giving off, when heated, a faint odor of petroleum. If a portion of Hard Petrolatum be liquefied, and brought to a temperature of 60° C. (140° F.), it will have a specific gravity of about 0.820 to 0.850. The melting point of Hard Petrolatum ranges between about 45° and 51° C. (113° and 125° F.). In other respects Hard Petrolatum has the characteristics of, and should respond to the tests given under, Liquid Petrolatum (see *Petrolatum Liquidum*).

Hard *paraffin*, or paraffin wax, is a solid, white, diaphanous substance resembling white wax, which is made by distilling the residuum obtained from the refiners of petroleum and collecting and purifying the distillate.

Paraffin, in its pure condition, is a white, waxy, inodorous, tasteless substance, harder than tallow, softer than wax, with a specific gravity of 0.877. Its melting point is variable, depending somewhat upon its origin. It ranges between 43° C. and 65° C. (109° F. and 151° F.). It is insoluble in water, is indifferent to the most powerful acids, alkalies, and chlorine, and can be distilled unchanged with strong oil of vitriol. Warm alcohol, ether, oil of turpentine, olive oil, benzol, chloroform, and carbon disulphide dissolve it readily. It can be mixed in all proportions with wax, stearin, palmitin, and resin, but it is difficult to prevent the mixtures from "granulating," even after prolonged stirring.

BENZINUM. *U.S.* Benzin.

[PETROLEUM BENZIN. PETROLEUM ETHER.]

A purified distillate from American petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series [C_5H_{12}, C_6H_{14}], and homologous compounds. Benzin should be carefully kept in well-stoppered bottles or tin cans, in a cool place, remote from lights or fire.

Benzinum. *U.S.*	Odor and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A transparent, colorless, diffusive liquid. It is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently. Sp. gr. 0.670 to 0.675.	Strong, characteristic odor, slightly resembling that of petroleum, but much less disagreeable; neutral reaction.	Insoluble.	6 parts.	Readily soluble in ether, chloroform, benzol, and fixed and volatile oils.

Test for Identity.	Impurities.	Tests for Impurities.
It should require 6 parts of official alcohol to dissolve Benzin (difference from *benzol*).	Heavy Hydrocarbons.	Benzin, when evaporated upon the hand, should leave no odor, and, when evaporated in a warmed dish, should leave no residue.
	Pyrogenous Products and Sulphur Compounds.	When Benzin is boiled a few minutes with one-fourth its volume of spirit of ammonia and a few drops of silver nitrate T.S., the ammoniacal liquid should not turn brown.
	Benzol.	If 5 drops of Benzin be added to a mixture of 40 drops of sulphuric acid with 10 drops of nitric acid, in a test-tube, the liquid warmed for about ten minutes and set aside for half an hour, and then diluted, in a shallow dish, with water, it should not evolve the bitter-almond like odor of nitro-benzol.

Uses.—Benzin is a useful solvent for fats, resins, oils, caoutchouc, and similar bodies. It is not identical with benzol, the product obtained in the destructive distillation of coal (see page 789).

Unofficial Petroleum Products.

Ceresin. (Ozokerite.) (Earth-wax.)	A natural mineral product introduced into commerce as a substitute for wax. Sp. gr. 0.753 at 98° C.
Kandol. Canadol.	A very volatile fraction of petroleum. Used for rapidly freezing skin and subdermal tissues.
Ligroine. Ligroin.	A petroleum product, boiling between 80° C. and 120° C. Chiefly used as a solvent.
Rhigolene.	A very light, inflammable liquid, boiling at about 18° C. (64.4° F.). Used for producing cold by evaporation.

QUESTIONS ON CHAPTER LVIII.

FIXED OILS, FATS, AND SOAPS.

Fixed oils and fats—Whence are they obtained?
What are their general properties, solubilities, etc.?
What is their specific gravity?
What change takes place upon exposure to air?
How may oils which have become rancid often be purified?
What are fixed oils and fats, chemically?
In most cases, of what do they consist?
What are these proximate principles sometimes termed?
To what is the consistence of fixed oils and fats due?
Why is almond oil liquid and tallow solid at ordinary temperatures?
Chemically considered, what is olein? What is its formula in symbols?
How may it be obtained?
What are the physical properties of olein?
How does palmitic acid occur?
Chemically, what is palmitin?
Stearin—Where is it found, and how is it made?
How may it be obtained pure? Describe odor, taste, and chemical reaction.
What is its melting-point?
Of what does it consist, and how has it been formed synthetically?
Margarin—What has the substance long known under this name been shown to be?
How has margaric acid been obtained?
Stearic acid—What is the formula in symbols?
Describe odor, taste, and chemical reaction. For what is it used?
Palmitic acid—What is the formula in symbols?
What is its form? Its melting-point?
Oleic acid—What is the formula in symbols?
Describe odor, taste, and chemical reaction.
At what temperature does it crystallize?
Sweet almond—What is the Latin name? What does it contain?
How does the fixed oil form an emulsion by simple trituration of the almond with water? What are its official preparations?
Expressed oil of almond—What is the Latin name?
Whence and how is this oil obtained?
How much oil does sweet almond yield?
How much oil does bitter almond yield?
How may a colorless oil be obtained?
What is its specific gravity? Describe odor, taste, chemical reaction, and solubility. Of what does it principally consist?
At what temperature does it congeal?

How may it be distinguished from most other fixed oils?
For what is it used?
Olive oil—Whence is it obtained?
Is commercial olive oil believed to be usually pure?
Can its purity be ascertained easily? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
How may impurities of other fixed oils of similar physical properties be detected?
What are its uses?
Cotton seed oil—Whence is it obtained, and where is it made?
How much oil does cotton seed contain? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
At what temperature does it begin to congeal?
What effect does concentrated sulphuric acid have upon it?
For what is it used?
Oil of sesamum—What is its synonyme? Whence is it obtained?
What are its constituents? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
At what temperature does it congeal?
What effect does concentrated sulphuric acid have upon it?
What are its uses?
Oil of linseed—What is the Latin name? What is its synonyme?
How is it prepared?
Of what does it consist?
To what does it owe its drying property? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
At how low a temperature does it remain liquid?
What is the dose?
Pumpkin seed—What is the Latin official name? Whence is it derived?
What are its constituents?
For what is it used, and in what form?
How is the fixed oil obtained?
Castor oil—Whence is it derived?
In what four ways has castor oil been obtained?
Which method produces the best oil?
What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility.
At what temperature does it congeal?
What does it contain?
To what is the purgative action due? How is this shown?
What is the dose?
Croton oil—What is the Latin official name? Whence is it derived?
How is it prepared? What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What effect does it produce when applied to the skin?
Have the active principles been isolated?
What acids have been detected as having been formed by the decomposition of the fatty substances present?
What is the chemical composition of crotonol?
What is the dose?
Oil of theobroma—What is the Latin name? What is its synonyme?
Whence is it derived? How is it made? What is the yield of oil?
Describe odor, taste, and chemical reaction. What is its melting-point?
How may its purity be tested?
What are its chemical constituents?
For what is it used?
Lycopodium—What is lycopodium?
What does it contain? What are its uses?
Oleic acid—What is the Latin name?
Give the formula in symbols and molecular weight.
How is it obtained?
What is "red oil"? What is the specific gravity?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: More than traces of palmitic and stearic acids; fixed oils.
What are its uses? Why is it especially useful?

Glycerin—What is its percentage of absolute glycerin?
What is the chemical composition of absolute glycerin?
How is glycerin obtained?
Explain the reaction which takes place in making lead plaster.
What is Tilghman's process for making it?
Explain the reaction which takes place in making glycerin by this process from stearin.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Butyric acid; cane-sugar; sugars and dextrin, which leave a porous coal; sugars; metallic salts; acrylic, hydrochloric, sulphuric, or oxalic acid, iron, or calcium salts.
Chemically, to what class does glycerin belong, and what is it sometimes called?
What is its atomicity? What are its uses?
Soap—What is the Latin name? What is its synonyme?
What is its definition?
How is it made? What is grain soap?
How may it be purified?
How is toilet soap made?
What is the difference between hard soaps and soft soaps?
What change takes place when fats and oils undergo saponification?
What is the difference between soluble and insoluble soaps?
What are the two official soaps, and to which class do they belong?
What insoluble soaps are employed in pharmacy?
Describe its odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: An undue amount of water; animal fat; sodium carbonate; silica and other accidental impurities; metals.
What are its medicinal properties?
What are its uses? What are its official preparations?
Soft soap—What is the Latin official name? What was its name in the U. S. P. 1880 in Latin? in English?
How and where is it usually made?
Describe its odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: An undue amount of water; free fats; insoluble carbonates; starch.
For what is it used? What is its official preparation?
Petrolatum—What is petrolatum? How many kinds of petrolatum are official?
How are they prepared? What are their melting-points?
When petrolatum is ordered, its melting-point not being specified, which variety is to be dispensed?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Fixed oils or fats of vegetable or animal origin, or resin; readily carbonized organic impurities.
What is its use? By what names is it known commercially?
What is paraffin? What is its specific gravity?
Describe odor, taste, chemical reaction, and solubility.
What effect has strong sulphuric acid upon it?
Can it be mixed readily with wax, resin, stearin, etc.?
Does it make a smooth mixture?
Benzin—Give the Latin name and synonyme. What is benzin?
What is its specific gravity? What is its boiling-point?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—Heavy hydrocarbons; pyrogenous products and sulphur compounds; benzol.
For what is it used?
Is it identical with benzol?

CHAPTER LIX.

DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES, WITH THEIR PREPARATIONS.

GLUCOSIDES are bodies mostly found in plants, yielding glucose, $C_6H_{12}O_6$, as one of their products of decomposition when heated in contact with a diluted mineral acid and water. The other product which is formed at the same time differs in character from the original glucoside. Thus, *Salicin*, if boiled with diluted sulphuric acid, yields dextro-glucose and *saligenin*, or *saligenol*.

$$\underset{\text{Salicin.}}{C_{13}H_{18}O_7} + \underset{\text{Water.}}{H_2O} = \underset{\text{Saligenin.}}{C_7H_8O_2} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

Glucosides may sometimes be split into glucose and the derived product by heating them with baryta water or alkaline solutions, by nitrogenous principles, which act as ferments, like *emulsin* or *synaptase*, or by treatment with yeast ferment or *ptyalin* found in saliva.

Glucosides are sometimes the active principles of the plants in which they are found, but they are more frequently associated with resins, oils, alkaloids, and bitter principles, and for this reason they have not been used to form a separate group for classification in this work: frequent mention, however, will be made of them when the occasion arises, in connection with the drug containing them, and the official drugs containing neutral principles have been classed with them.

The following list gives a view of some of the glucosides, with their derivatives:

Glucosides.

GLUCOSIDE.	SOURCE.	DERIVATIVE.
Æsculin, $C_{21}H_{24}O_{13}$.	From *Æsculus Hippocastanum*.	Æsculetin.
Amygdalin, $C_{20}NH_{27}O_{11}$.	From *Amygdalus communis*.	Oil of bitter almond and hydrocyanic acid.
Arbutin, $C_{12}H_{16}O_7$.	From *Uva Ursi* and other Ericaceæ.	Hydrokinone and methylhydrokinone.
Bryonin, $C_{48}H_{80}O_{19}$.	From *Bryonia alba* and *B. dioica*.	Bryoretin and hydrobryoretin.
Colocynthin, $C_{56}H_{84}O_{23}$.	From *Citrullus colocynthis*.	Colocynthein.
Convallamarin, $C_{23}H_{44}O_{12}$.	From *Convallaria majalis*.	Convallamaretin.
Convallarin, $C_{34}H_{62}O_{11}$.	From *Convallaria majalis*.	Convallaretin.
Convolvulin, $C_{31}H_{50}O_{16}$.	From *Exogonium Purga*.	Convolvulinol and convolvulinolic acid.
Crocin, $C_{29}H_{42}O_{15}$.	From *Crocus sativus*.	Crocetin.
Daphnin, $C_{31}H_{34}O_{19}$.	From *Daphne Mezereum*.	Daphnetin.
Datiscin, $C_{21}H_{22}O_{12}$.	From *Datisca cannabina*.	Datiscetin.
Digitalin, $C_{27}H_{45}O_{15}$.	From *Digitalis purpurea*.	Digitaliretin and paradigitaliretin.

Glucosides.—(*Continued.*)

GLUCOSIDE.	SOURCE.	DERIVATIVE.
Elaterin, $C_{20}H_{28}O_5$.	From *Elaterium.*	
Fraxin, $C_{32}H_{36}O_{20}$.	From *Fraxinus Ornus.*	Fraxetin.
Gentiopicrin, $C_{20}H_{30}O_{12}$.	From *Gentiana lutea.*	Gentiogenin.
Globularin, $C_{30}H_{44}O_{14}$.	From *Globularia Alypum.*	Globularetin.
Glycyrrhizin, $C_{24}H_{36}O_9$.	From *Glycyrrhiza glabra.*	Glycyrretin.
Gratiolin, $C_{20}H_{34}O_7$.	From *Gratiola officinalis.*	Gratioletin and gratiolaretin.
Gratiosolin, $C_{46}H_{84}O_{25}$.	From *Gratiola officinalis.*	Gratiosoletin.
Helecin, $C_{13}H_{16}O_7$.	From Salicin.	Salicyl aldehyd.
Indican.	From Indigo.	Indiglucin.
Jalapin, $C_{68}H_{112}O_{32}$.	From *Ipomœa Jalapa.*	Jalapinol.
Ononin, $C_{30}H_{34}O_{13}$.	From *Ononis spinosa.*	Formonetin.
Phillyrin, $C_{27}H_{34}O_{11}$.	From *Phillyria latifolia.*	Phillygenin.
Phlorizin, $C_{21}H_{24}O_{10}$.	From the bark of the pear, apple, cherry, and plum tree.	Phloretin.
Pinipicrin, $C_{22}H_{36}O_{11}$.	From *Thuja occidentalis.*	Ericinol.
Populin, $C_{20}H_{22}O_8$.	From different species of Populus.	Benzoic acid, saliretin.
Prophetin, $C_{23}H_{36}O_7$.	From *Cucumis prophetarum.*	Propheretin.
Quercitrin, $C_{35}H_{36}O_{20}$.	From *Quercus tinctoria.*	Quercetin.
Quinovin, $C_{30}H_{48}O_8$.	From the bark of Cinchonas.	Quinovic acid.
Salicin, $C_{13}H_{18}O_7$.	From different species of Salix and Populus.	Saligenin.
Santonin, $C_{15}H_{18}O_3$.	From *Artemisia maritima.*	Santoniretin.
Saponin, $C_{32}H_{54}O_{18}$.	From *Saponaria officinalis.*	Saponetin.
Thujin, $C_{20}H_{22}O_{12}$.	From *Thuja occidentalis.*	Thujigenin and thujetin.
Xanthorhamnin, $C_{23}H_{28}O_{14}$.	From *Rhamnus amygdalinus.*	Rhamnetin.

GENTIANA. *U.S.* Gentian.

The root of *Gentiana lutea* Linné (nat. ord. *Gentianeæ*).

Gentian contains the glucoside *gentiopicrin* (which splits, when heated with dilute acids, into gentiogenin and grape-sugar), *gentisic* acid, $C_{14}H_{10}O_5$, pectin, sugar (gentianose), and a little fixed oil. A dark-green coloration is produced when a ferric salt is added to a preparation of gentian: this is said to be due to the reaction with gentisic acid; if the preparation is treated with ferric hydrate, and then filtered, the tendency to become discolored is lost. Gentian is a bitter tonic.

Official Preparations.

Extractum Gentianæ Fluidum Fluid Extract of Gentian.	Made with a menstruum of diluted alcohol (see page 407). Dose, ten to thirty minims (0.6 to 1.8 C.c.).
Extractum Gentianæ Extract of Gentian.	An aqueous extract made with cold water (see page 449). Dose, ten to thirty grains (0.6 to 1.9 Gm.).
Tinctura Gentianæ Composita Compound Tincture of Gentian.	Made by mixing 100 Gm. of gentian, 40 Gm. of bitter orange peel, and 10 Gm. of cardamom together, and percolating with a menstruum made by mixing 3 parts of alcohol with 2 parts of water to obtain 1000 C.c. (see page 368). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

CALUMBA. *U.S.* Calumba. [COLUMBO.]

The root of *Jateorhiza palmata* (Lamarck) Miers (nat. ord. *Menispermaceæ*).

This African root owes its virtues to *colombin*, $C_{21}H_{22}O_7$, and *berberine*, both of which are very bitter; starch and colombic acid are present, with a mucilage which is often troublesome by interfering with per-

colating operations. Calumba must not be in very fine powder if it is to be percolated with diluted alcohol. It is a bitter tonic.

Official Preparations.

Extractum Calumbæ Fluidum . Fluid Extract of Calumba.	Made with a menstruum of 3 parts of alcohol and 1 part of water; the calumba in No. 20 powder (see page 398). Dose, fifteen to thirty minims (0.9 to 1.8 C.c.).
Tinctura Calumbæ . . . . . . Tincture of Calumba.	Made by percolating 100 Gm. of calumba, in No. 20 powder, with sufficient menstruum, consisting of 3 parts of alcohol and 2 parts of water, to make 1000 C.c. (see page 362). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

QUASSIA. *U.S.* Quassia.

The wood of *Picræna excelsa* (Swartz) Lindley (nat. ord. *Simarubeæ*).

Quassia contains *quassin*, $C_{10}H_{12}O_3$, which is intensely bitter, and soluble in both alcohol and water; there are also present resin, mucilage, etc. It is a bitter tonic.

Official Preparations.

Extractum Quassiæ Fluidum . Fluid Extract of Quassia.	Made with a menstruum of 1 part of alcohol and 2 parts of water (see page 418). Dose, five to ten minims (0.3 to 0.6 C.c.).
Extractum Quassiæ . . . . . Extract of Quassia.	An aqueous extract, made with cold water (see page 456). Dose, one to two grains (0.06 to 0.13 Gm.).
Tinctura Quassiæ . . . . . . Tincture of Quassia.	Made by percolating 100 Gm. of quassia with a menstruum of 35 parts of alcohol and 65 parts of water to obtain 1000 C.c. (see page 375). Dose, one-half to one fluidrachm (1.7 to 3.4 C.c.).

CHIRATA. *U. S.* Chirata.

The entire plant, *Swertia Chirata* Hamilton (nat. ord. *Gentianeæ*).

Chirata contains a bitter glucoside, *chiratin*, $C_{26}H_{48}O_{15}$, and a very bitter principle, ophelic acid, $C_{13}H_{20}O_{10}$. It is used as a tonic and febrifuge.

Official Preparations.

Extractum Chiratæ Fluidum . Fluid Extract of Chirata.	Made with a menstruum prepared by mixing 2 parts of alcohol to 1 part of water (see page 400). Dose, half a fluidrachm (1.8 C.c.).
Tinctura Chiratæ . . . . . . Tincture of Chirata.	Made by percolating 100 Gm. of chirata with sufficient menstruum, made by mixing 65 parts of alcohol to 35 parts of water to make 1000 C.c. (see page 364). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

SALICINUM. *U. S.* Salicin.

$C_{13}H_{18}O_7 = 285.83.$

A neutral principle obtained from several species of *Salix* and *Populus* (nat. ord. *Salicaceæ*).

Preparation.—A boiling concentrated decoction of the bark is treated with lead oxide until it becomes nearly colorless. Gum, tannin, and extractive matter, which would impede the crystallization of the salicin, are thus removed from the liquid; while a portion of the oxide is dissolved in combination probably with the salicin. To separate this portion of oxide, sulphuric acid is first added, and then barium sulphide, and the liquor is filtered and evaporated. Salicin is deposited, and may be purified by repeated solution and crystallization. It is a glucoside, splitting into saligenin and sugar under the influence of dilute acids and heat.

Salicinum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Colorless or white, silky, shining crystalline needles, or a crystalline powder, permanent in the air. When heated to 198° C. (388.4° F.), Salicin melts, yielding a colorless liquid, which, on cooling, congeals to a crystalline mass. Upon ignition it is consumed, leaving no residue.	Odorless; very bitter taste; neutral reaction.	At 15° C. (59° F.), 28 parts. Boiling, 0.7 part.	At 15° C. (59° F.), 30 parts. Boiling, 2 parts.	Almost insoluble in ether or chloroform.

Tests for Identity.	Impurities.	Test for Impurities.
On heating a small portion of Salicin, in a test-tube, until it turns brown, then adding a few C.c. of water, and afterwards a drop of ferric chloride T.S., a violet color will be produced. Cold, concentrated, sulphuric acid dissolves Salicin with a red color; the solution, after the addition of water, becomes colorless, and deposits a dark red powder, insoluble in water or alcohol. On heating a small portion of Salicin with 1 C.c. of potassium dichromate T.S. and 2 C.c. of sulphuric acid, the odor of salicylic aldehyde (or of oil of meadow-sweet, *Spiræa ulmaria*, Linné, nat. ord. *Rosaceæ*) will become noticeable.	Alkaloids.	The aqueous solution of Salicin is not precipitated by tannic or picric acid, nor by mercuric potassium iodide T.S.

Uses.—Salicin is used as a febrifuge, in doses of twenty to thirty grains (1.3 to 1.9 Gm.).

TARAXACUM. *U. S.* Taraxacum. [Dandelion.]

The root of *Taraxacum officinale* Weber (nat. ord. *Compositæ*), gathered in autumn.

Taraxacum owes its bitterness to *taraxacin*, $C_8H_{16}O$, an acrid crystalline principle, soluble in alcohol and water. It also contains pectin, sugar, resin, gum, etc.

Official Preparations.

Extractum Taraxaci Fluidum . Fluid Extract of Taraxacum.	Made with a menstruum of diluted alcohol (see page 426). Dose, one to three fluidrachms (3.7 to 7.4 C.c.).
Extractum Taraxaci . . . . . Extract of Taraxacum.	An inspissated juice from fresh taraxacum (see page 457). Dose, thirty to sixty grains (1.9 to 3.8 Gm.).

LAPPA. *U. S.* Lappa. [Burdock.]

The root of *Arctium Lappa* Linné, and of some other species of *Arctium* (nat. ord. *Compositæ*).

Lappa contains a bitter substance, inulin, sugar, mucilage, etc.

Official Preparation.

Extractum Lappæ Fluidum . Fluid Extract of Lappa.	Made with a menstruum of diluted alcohol (see page 412). Dose, thirty to sixty minims (1.8 to 3.7 C.c.).

SCILLA. *U. S.* Squill.

The bulb of *Urginea maritima* (Linné) Baker (nat. ord. *Liliaceæ*), deprived of its dry, membranaceous outer scales, and cut into thin slices, the central portions being rejected.

Squill contains the bitter principle *scillipicrin*, *scillitoxin*, *scillin*, and *scillain*, a poisonous glucoside. There are also present a large quantity

of mucilage, calcium oxalate, sinistrin, etc. Water and alcohol extract its virtues. It is expectorant, emetic, and diuretic.

Official Preparations.

Acetum Scillæ . . . . Vinegar of Squill.	Made by percolating 100 Gm. of ground squill previously macerated in 900 C.c. of diluted acetic acid with the latter until 1000 C.c. are obtained (see page 437). Dose, fifteen to thirty minims (0.9 to 1.8 C.c.).
Extractum Scillæ Fluidum . Fluid Extract of Squill.	Made with a menstruum of 3 parts of alcohol and 1 part of water, thus avoiding the solution of the squill mucilage (see page 422). Dose, two to three minims (0.12 to 0.19 C.c.).
Syrupus Scillæ . . . . Syrup of Squill.	Made by dissolving 800 Gm. of sugar in 450 C.c. of vinegar of squill and enough water to make 1000 C.c. (see page 310). Dose, thirty minims (1.8 C.c.).
Syrupus Scillæ Compositus . Compound Syrup of Squill.	Made with 80 C.c. each of fluid extracts of squill and senega, 2 Gm. of antimony and potassium tartrate, 750 Gm. of sugar, precipitated calcium phosphate to aid in clearing the filtrate, and enough water to make 1000 C.c. (see page 310). Dose, fifteen to thirty minims (0.9 to 1.8 C.c.).
Tinctura Scillæ . . . . . . Tincture of Squill.	Made by percolating 150 Gm. of squill with sufficient menstruum, made by mixing 3 parts of alcohol and 1 part of water, to make 1000 C.c. (see page 378). Dose, ten to twenty minims (0.6 to 1.2 C.c.).

DIGITALIS. *U. S.* Digitalis. [FOXGLOVE.]

The leaves of *Digitalis purpurea* Linné (nat. ord. *Scrophularineæ*), collected from plants of the second year's growth.

Digitalis has been the subject of exhaustive investigation. The principle digitalin was at one time considered to be an alkaloid. It is, as usually seen, a mixture of digitoxin and other neutral principles. Digitoxin is converted into *toxiresin* by the action of diluted acids and heat. Digitalis is used as a sedative and cardiac stimulant.

Official Preparations.

Infusum Digitalis . . . . . . Infusion of Digitalis.	Made by pouring 500 C.c. of boiling water on 15 Gm. of digitalis, and, after macerating and straining, adding 100 C.c. of alcohol, 150 C.c. of cinnamon water, and water enough to make 1000 C.c. (see page 349). Dose, half a fluidounce (14.7 C.c.).
Extractum Digitalis Fluidum . Fluid Extract of Digitalis.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 404). Dose, one to two minims (0.06 to 0.12 C.c.).
Extractum Digitalis . . . . . Extract of Digitalis.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 448). Dose, half a grain (0.03 Gm.).
Tinctura Digitalis . . . . . . Tincture of Digitalis.	Made by percolating 150 Gm. of digitalis with sufficient diluted alcohol to make 1000 C.c. (see page 366). Dose, ten to fifteen minims (0.6 to 0.9 C.c.).

CONVALLARIA. *U. S.* Convallaria.

The rhizome and roots of *Convallaria majalis* Linné (nat. ord. *Liliaceæ*).

This drug contains *convallarin*, a glucoside, which is split into *convallaretin* and glucose by the action of dilute acids; it also contains another glucoside, *convallamarin*, which is the active principle. Convallaria is a valuable sedative and cardiac stimulant, and is often used in place of digitalis. The fluid extract is the best preparation.

Official Preparation.

Extractum Convallariæ Fluidum . Fluid Extract of Convallaria.	Made with a menstruum of diluted alcohol (see page 402). Dose, five to fifteen minims (0.3 to 0.9 C.c.).

STROPHANTHUS. *U. S.* Strophanthus.

The seed of *Strophanthus hispidus* De Candolle (nat. ord. *Apocynaceæ*), deprived of its long awn.

Strophanthus contains a glucoside, *strophanthin*, an alkaloid, *inœline*, fatty matter, resin, extractive, etc. Strophanthin is the active principle. Alcohol and water extract it. Ether and benzin are sometimes used to percolate the drug with, to deprive it of the fatty matter before exhausting it with alcohol.

Official Preparation.

Tinctura Strophanthi . . . Made by percolating 50 Gm. of powdered strophanthus with a menstruum of 65 parts of alcohol and 35 parts of water until 1000 C.c. are obtained (see page 378). Dose, ten minims (0.6 C.c.).
Tincture of Strophanthus.

SPIGELIA. *U. S.* Spigelia. [PINKROOT.]

The rhizome and roots of *Spigelia marilandica* Linné (nat. ord. *Loganiaceæ*).

Spigelia contains a bitter principle, resin, and a trace of volatile oil, with tannin and wax. It is used as an anthelmintic. Alcohol and water extract its virtues.

Official Preparation.

Extractum Spigeliæ Fluidum . . Made with a menstruum of diluted alcohol (see page 425). Dose, one to two fluidrachms (3.6 to 7.3 C.c.).
Fluid Extract of Spigelia.

CUSSO. *U. S.* Kousso. [BRAYERA, PHARM. 1880.]

The female inflorescence of *Hagenia abyssinica* (Bruce) Gmelin (nat. ord. *Rosaceæ*).

Brayera contains a bitter resinous principle, kosin, $C_{31}H_{38}O_{10}$, about 24 per cent. of tannin, gum, sugar, etc. It is used as an anthelmintic.

Official Preparation.

Extractum Cusso Fluidum . . Made with a menstruum of alcohol (see page 403). Dose, one-half to one fluidounce (14.7 to 29.5 C.c.).
Fluid Extract of Kousso.

SANTONICA. *U. S.* Santonica. [LEVANT WORMSEED.]

The unexpanded flower-heads of *Artemisia pauciflora* Weber (nat. ord. *Compositæ*).

Santonica contains about 2 per cent. of *santonin*, resin, volatile oil, gum, etc. It is used as an anthelmintic. The dose is fifteen to fifty grains (0.9 to 3.2 Gm.).

SANTONINUM. *U. S.* Santonin.

$C_{15}H_{18}O_3$; 245.43.

A neutral principle obtained from Santonica. It should be kept in dark, amber-colored vials, and should not be exposed to light.

Preparation.—Santonin may be made by exhausting santonica mixed with lime with diluted alcohol, distilling off the alcohol, and adding acetic acid to the residue. The precipitated santonin is purified by dissolving it in alcohol, treating with animal charcoal, and crystallizing. Santonin forms soluble compounds with alkalies, and it may be precipitated from its solutions by acids.

Santoninum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, shining, flattened, prismatic crystals, not altered by exposure to air, but turning yellow on exposure to light. When heated to 170° C. (338° F.), Santonin melts, and forms, if rapidly cooled, an amorphous mass, which instantly crystallizes on coming in contact with a minute quantity of one of its solvents. At a higher temperature it sublimes, partly unchanged, and, when ignited, it is consumed, leaving no residue.	Odorless; nearly tasteless when first placed in the mouth, but afterwards bitter; neutral reaction.	Cold, Nearly insoluble. Boiling, 250 parts.	At 15° C. (59° F.), 40 parts. Boiling, 3 parts.	Soluble in 140 parts of ether, in 4 parts of chloroform, and in solutions of caustic alkalies.

Tests for Identity.	Impurities.	Tests for Impurities.
With alcoholic solution of potassium hydrate, Santonin yields a bright pinkish-red liquid, which gradually becomes colorless. From its solution in alkalies it is completely precipitated by supersaturating with an acid.	Brucine or Strychnine.	If water be added, immediately after it is dissolved without color in sulphuric acid, it is completely precipitated, and the supernatant liquor should not have a bitter taste, nor should it be altered upon the addition of potassium dichromate T.S.,
	Alkaloids in general.	Or of mercuric potassium iodide T.S.
	Easily Carbonizable, Organic Substances.	Its solution in cold, concentrated sulphuric acid is at first colorless, but after some time it turns yellow, then red, and finally brown.

Uses.—Santonin is used as an anthelmintic, in doses of two grains (0.13 Gm.).

Official Preparation.

Trochisci Santonini . . Each troche contains about half a grain of santonin.
Troches of Santonin.

PICROTOXINUM. *U. S.* Picrotoxin.

$C_{30}H_{34}O_{13} = 600.58.$

A neutral principle obtained from the seed of *Anamirta paniculata* Colebrooke (nat. ord. *Menispermaceæ*).

Preparation.—Picrotoxin is made from the kernel of cocculus Indicus by treating an aqueous extract, which has been triturated with magnesia, with hot alcohol; the solution is evaporated, and the crystalline mass purified by recrystallization after decolorizing with animal charcoal.

Picrotoxinum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, flexible, shining, prismatic crystals, or a micro-crystalline powder, permanent in the air. When heated to about 200° C. (392° F.), the crystals melt, forming a yellow liquid, and upon ignition it is consumed, leaving no residue.	Odorless, very bitter taste; neutral reaction.	At 15° C. (59° F.), 240 parts. Boiling, 25 parts.	At 15° C. (59° F.), 9 parts. Boiling, 3 parts.	Soluble in acids and in solutions of the alkalies; very slightly soluble in ether or chloroform.

TESTS FOR IDENTITY.

Concentrated sulphuric acid dissolves Picrotoxin with a golden-yellow color, very gradually changing to reddish-brown, and showing a brown fluorescence.

On mixing about 0.2 Gm. of powdered sodium nitrate with 3 or 4 drops of sulphuric acid, in a small flat-bottomed capsule, sprinkling a minute quantity of Picrotoxin over it, and then adding from a pipette concentrated solution (1 in 4) of sodium hydrate, drop by drop, until it is in excess, the particles of Picrotoxin will acquire a brick-red to deep red color, which fades after some hours.

On diluting 2 C.c. of alkaline cupric tartrate V.S. with 10 C.c. of water, and adding a small portion of Picrotoxin, red cuprous oxide will be separated within half an hour at ordinary temperatures, and much more rapidly upon the application of heat.

The aqueous solution of Picrotoxin should remain unaffected by mercuric or platinic chloride T.S., tannic acid T.S., mercuric potassium iodide T.S., or other reagents for alkaloids (absence of *alkaloids*).

Uses.—It has been used as a tonic and antispasmodic, in doses of one-sixtieth of a grain (0.001 Gm.): it is very poisonous in large doses.

ERGOTA. *U.S.* Ergot. [ERGOT OF RYE.]

The sclerotium of *Claviceps purpurea* (Fries) Tulasne (class *Fungi*), replacing the grain of rye, *Secale cereale* Linné (nat. ord. *Gramineæ*).

Ergot should be only moderately dried. It should be preserved in a close vessel, and a few drops of chloroform should be dropped upon it from time to time to prevent the development of insects. When more than one year old, it is unfit for use.

Ergot owes its activity to *sclerotic acid*, *sclererythrin*, *scleromucin*, *scleroiodin*, and *picrosclerotin*; there are also present *scleroxanthin* and *sclerocrystallin*, with 25 per cent. of fixed oil, mycose, and protein compounds. Diluted alcohol is a good solvent for the active principles. It is used as a parturient and hæmostatic. Sclerotic acid has been used in medicine in doses of one-half to three-fourths of a grain (0.03 to 0.04 Gm.). Kobert believes that the activity of ergot is due to *ergotic* and *sphacelic acids* and the alkaloid *cornutine*.

Official Preparations.

Extractum Ergotæ Fluidum Fluid Extract of Ergot.	Made with a menstruum of 98 parts of diluted alcohol and 2 parts of acetic acid (see page 405). Dose, one-half to four fluidrachms (1.8 to 14.7 C.c.).
Extractum Ergotæ Extract of Ergot.	Made by evaporating the fluid extract of ergot to a pilular consistence (see page 449). Dose, five to twenty grains (0.3 to 1.2 Gm.).
Vinum Ergotæ Wine of Ergot.	Made by percolating 150 Gm. of ergot with a menstruum composed of 150 C.c. of alcohol and 850 C.c. of white wine to make 1000 C.c. (see page 382). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).

GOSSYPII RADICIS CORTEX. *U.S.* Cotton Root Bark.

The bark of the root of *Gossypium herbaceum* Linné, and of other species of *Gossypium* (nat. ord. *Malvaceæ*).

Cotton root bark contains a yellow resin, which becomes red upon exposure to air, fixed oil, tannin, starch, sugar, etc. It is emmenagogue. Dose, sixty grains (3.8 Gm.).

Official Preparation.

Extractum Gossypii Radicis Fluidum Fluid Extract of Cotton Root Bark.	Made with alcohol, 75 parts; glycerin, 25 parts; finishing with alcohol (see page 408). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).

CROCUS. *U. S.* Saffron.

The stigmas of *Crocus sativus* Linné (nat. ord. *Irideæ*).

Crocus. *U. S.*	Odor and Taste.
Separate stigmas, or three, attached to the top of the style, about 3 Cm. long, flattish-tubular, almost thread-like, broader and notched above; orange-brown. Saffron should not include the yellow styles. When pressed between filtering paper, it should not leave an oily stain. When chewed, it stains the saliva deep orange-yellow. When soaked in water, it should not deposit any pulverulent, mineral matter, nor show the presence of organic substances differing in shape from that described.	Peculiar, strong, aromatic odor; aromatic and bitterish taste.

Impurities.	Tests for Impurities.
Picric Acid and some other Coal-tar Colors.	On agitating 1 part of Saffron with 100,000 parts of water, the liquid will acquire a distinct yellow color. No color is imparted to benzin agitated with Saffron.
Added Water.	On drying Saffron at 100° C. (212° F.), it should not lose more than 14 per cent. of its weight.
Foreign Inorganic Substances.	When thus dried, and ignited with free access of air, 100 parts of the dry Saffron should not leave more than 7.5 per cent. of ash.

Saffron contains *polychroit*, $C_{48}H_{60}O_{18}$, a glucoside which splits into *crocin* and glucose, volatile oil, wax, fixed oil, protein compounds, sugar, wax, etc. Saffron is chiefly used as a coloring-substance. It is diaphoretic, anodyne, and carminative. Dose, twenty grains (1.2 Gm.).

Official Preparation.

Tinctura Croci . . . . Tincture of Saffron. — Made by percolating 10 Gm. of saffron with sufficient diluted alcohol to make 100 C.c. (see page 366).

SANTALUM RUBRUM. *U. S.* Red Saunders.

The wood of *Pterocarpus santalinus* Linné filius (nat. ord. *Leguminosæ*).

This wood contains *santalic acid*, a resinous substance, *pterocarpin*, and *santol*. It is used solely as a red coloring. (See Tinctura Lavandulæ Composita.)

RHUS TOXICODENDRON. *U. S.* Rhus Toxicodendron. [Poison Ivy.]

The fresh leaves of *Rhus radicans* Linné (nat. ord. *Anacardieæ*).

These leaves contain *toxicodendric acid*, fixed oil, tannin, mucilage, wax, etc. It is considered to be tonic, irritant, and rubefacient. Dose, five grains (0.3 Gm.).

Drugs containing Saponinoid Principles, with their Preparations.

QUILLAJA. *U. S.* Quillaja. [Quillaia, Pharm. 1880. Soap Bark.]

The inner bark of *Quillaja Saponaria* Molina (nat. ord. *Rosaceæ*).

This South American bark owes its action to a peculiar principle, *saponin*, $C_{32}H_{54}O_{18}$, a glucoside, splitting upon heating with dilute acid into *sapogenin* and sugar. Saponin is a sternutatory white powder,

soluble in alcohol and hot water; its aqueous solution froths when agitated, like soapsuds; it is found in several other drugs. Quillaja also contains calcium sulphate. It is used principally for cleansing silk. It is sometimes used as a medicine, and is irritant, diuretic, and stimulating.

Official Preparation.

Tinctura Quillajæ. Tincture of Quillaja.	Made by boiling 200 Gm. of quillaja with 800 C.c. of water, and, after evaporation to 600 C.c., adding 350 C.c. of alcohol and enough water to make 1000 C.c. (see page 376).

SARSAPARILLA. *U. S.* Sarsaparilla.

The root of *Smilax officinalis* Kunth, *Smilax medica* Chamisso et Schlechtendal, *Smilax papyracea* Duhamel, and of other, undetermined species of *Smilax* (nat. ord. *Liliaceæ*).

Sarsaparilla contains a glucoside analogous to, if not identical with, saponin, termed *parillin*. When boiled with dilute acids, it splits into *parigenin* and grape-sugar. There are also present starch, resin, coloring-matter, and extractive. It is popularly believed to be an alterative. Alcohol and water are good solvents.

Official Preparations.

Decoctum Sarsaparillæ Compositum . . . . . . Compound Decoction of Sarsaparilla.	Made by boiling 100 Gm. of sarsaparilla, 20 Gm. each of sassafras, guaiacum wood, and glycyrrhiza, and 10 Gm. of mezereum, with 1000 C.c. of water (see page 353). Dose, four to six fluidounces (118.3 to 177.4 C.c.)
Extractum Sarsaparillæ Fluidum . . . . Fluid Extract of Sarsaparilla.	Made with a menstruum composed of 1 part of alcohol and 2 parts of water (see page 421). Dose, thirty to sixty minims (1.8 to 3.7 C.c.).
Extractum Sarsaparillæ Fluidum Compositum . Compound Fluid Extract of Sarsaparilla.	Made by mixing 750 Gm. of sarsaparilla, 120 Gm. of glycyrrhiza, 100 Gm. of sassafras, and 30 Gm. of mezereum together, and percolating with a menstruum of 1 part of alcohol and 2 parts of water, with 10 per cent. of glycerin (see page 422). Dose, thirty to sixty minims (1.8 to 3.7 C.c.)
Syrupus Sarsaparillæ Compositus . . . . Compound Syrup of Sarsaparilla.	Made by mixing 200 C.c. of fluid extract of sarsaparilla, 15 C.c. each of the fluid extracts of glycyrrhiza and senna, 0.1 C.c. each of the oils of sassafras, anise, and gaultheria, dissolving in the mixture 650 Gm. of sugar, and adding enough water to make 1000 C.c. (see page 309). Dose, four fluidrachms (14.8 C.c.).

SENEGA. *U. S.* Senega.

The root of *Polygala Senega* Linné (nat. ord. *Polygaleæ*).

Senega contains *polygalic acid* (sometimes called *senegin*), fixed oil, pectose, etc. Polygalic acid is analogous to, if not identical with, saponin. Alcohol and water are good menstrua for extracting its virtues. Liquid preparations of senega are very apt to gelatinize, owing to the presence of pectin: this is obviated by using ammonia water or other alkali to dissolve it. Senega is a valuable expectorant and stimulant. It is used in compound syrup of squill (see page 310).

Official Preparations.

Extractum Senegæ Fluidum . Fluid Extract of Senega.	Made with a menstruum of 75 parts of alcohol, 20 parts of water, and 5 parts of ammonia water (see page 423). Dose, ten to thirty minims (0.6 to 1.2 C.c.).
Syrupus Senegæ . . . . . . Syrup of Senega.	Made with 200 C.c. of fluid extract of senega, 5 C.c. of ammonia water, 700 Gm. of sugar, and enough water to make 1000 C.c. (see page 310). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

CAULOPHYLLUM. *U.S.* Caulophyllum. [BLUE COHOSH.]

The rhizome and roots of *Caulophyllum thalictroides* (Linné) Michaux (nat. ord. *Berberidaceæ*).

Caulophyllum contains *saponin*, associated with resin, starch, gum, albumen, coloring-matter, extractive, etc. Alcohol is the best menstruum for extracting the virtues of this drug. It is sometimes used as an antispasmodic and emmenagogue.

Unofficial Drugs containing Glucosides or Bitter Principles.

Adonis Vernalis. Pheasant's Eye.	A cardiac stimulant. Contains the glucoside adonidin, of which the dose is one-third of a grain (0.02 Gm.).
Azedarach. Azedarach.	The bark of the root of *Melia Azedarach*. It contains a resinous principle, and is used as an emetic and anthelmintic, in doses of fifteen to thirty grains (0.9 to 1.9 Gm.).
Cassia Marilandica. American Senna.	Cathartic. Used in the form of infusion.
Chamælirium. Starwort.	The rhizome of *C. luteum* and other species. It contains about 8 per cent. of the glucoside chamælirin.
Cocillana Bark. Sycocarpus Rusbyi.	Stimulant, expectorant. Dose of fluid extract, ten to twenty-five drops (0.49 to 1.23 Gm.).
Condurango.	Contains *condurangin*, an amorphous powder, soluble in water, alcohol, and chloroform. It is poisonous.
Cornus. Dogwood.	The bark of the root of *Cornus florida*. It contains a bitter principle, *cornin*.
Coronilla Scorpioides.	Cardiac stimulant, diuretic.
Coto Bark.	Contains cotoin, $C_{22}H_{18}O_6$. Used in diarrhœa. Dose, three grains (0.194 Gm.); dose of cotoin, one grain (0.065 Gm.).
Frasera. American Calumba.	The root of *F. Walteri*, indigenous to the United States. It contains gentisic acid and gentiöpicrin.
Gillenia. Gillenia.	The rhizome of *G. trifoliata* and others, indigenous to the United States. It contains the bitter principle of gillenin, resin, tannin, etc.
Gratiola. Hedge-Hyssop.	From *G. officinalis*, indigenous to Southern Europe. It contains a bitter glucoside, gratiolin, etc.
Hedera Helix. Ivy.	Contains a glucoside, and hederic and tannic acids. Dose, twenty grains (1.3 Gm.) or more, dried and powdered, given in the atrophy of children.
Helleborus. Black Hellebore.	The rhizome of *H. niger*, grown in Europe. It contains a crystalline glucoside, helleborin, $C_{26}H_{44}O_{15}$.
Ilex. Holly.	The leaves of different species of *Ilex*, indigenous to the United States. It contains ilixanthin, $C_{17}H_{22}O_{11}$, and ilicic acid.
Ledum. Marsh Tea.	The leaves of *L. palustre*, grown in North America. It contains the glucoside ericolin, $C_{34}H_{56}O_{21}$; also about 1 per cent. of volatile oil.
Ligustrum. Privet.	The leaves of *L. vulgare*, indigenous to Southern Europe. It contains ligustrin, etc.
Liriodendron. Tulip-Tree Bark.	The bark of *L. tulipifera*, found in the Northern United States. It contains liriodendrin, which occurs in white prisms.
Lupinus Albus. Lupin.	Contains a glucoside, lupinin, $C_{29}H_{32}O_{16}$. The seeds are anthelmintic, diuretic, and emmenagogue.
Megarrhiza Californica. (Man-Root.)	It contains a resinous substance called megarrhizitin, and a glucoside called megarrhin, possessing mydriatic properties.
Melilotus. Melilot.	The leaves and flowering branches of *M. officinalis*, indigenous to Europe. It contains coumarin, $C_9H_6O_2$, and melilotic acid, $C_9H_{10}O_3$.
Panax. Ginseng.	The root of *P. quinquefolium*, found in North America. It contains panaquilon, $C_{12}H_{25}O_9$.
Para-Coto Bark.	Contains para-cotoin, $C_{19}H_{12}O_6$.

Unofficial Drugs containing Glucosides or Bitter Principles.—*Continued.*

Piscidia Erythrina. Jamaica Dogwood.	Narcotic, anodyne. Dose of fluid extract is a fluidrachm (3.69 C.c.), to be carefully increased.
Prinos. Black Alder.	The bark of *Prinos verticillatus*. It contains a bitter principle. It is a tonic, astringent, and alterative.
Rhamnus Catharticus. Purging Buckthorn.	From *R. catharticus*, found in Europe. It contains rhamnocathartin, which occurs as a yellowish mass, etc.
Ruta. Rue.	The leaves of *R. graveolens*, which grows in Southern Europe. It contains a volatile oil and rutin, $C_{25}H_{28}O_{15}$, which occurs in needle-shaped crystals. Emmenagogue. Dose, fifteen to thirty grains (0.972–1.94 Gm.), two or three times a day, preferably given in infusion.
Sabbatia. American Centaury.	A simple bitter. Dose, a drachm (3.88 Gm.), given in the form of fluid extract or decoction.
Salix. Willow.	The bark of *Salix alba*, and of other species of Salix. It contains a glucoside, *salicin* ($C_{13}H_{18}O_7$).
Saponaria Officinalis. Soapwort. Bouncing Bet.	Contains a glucoside, saponin.
Simaruba. Simaruba.	The bark of the root of *S. officinalis*, grown in South America. It contains a bitter principle, a volatile oil, etc. Tonic. Dose, from twenty to sixty grains (1.296 to 3.88 Gm.), best given in infusion.
Taxus. Yew.	From *Taxus baccata*, grown in Asia. It contains volatile oil, taxina, etc.
Ustilago. Corn Smut.	From *Zea Mays*. It contains a principle analogous to sclerotic acid. Used as a parturient. Dose, fifteen to thirty grains (0.9 to 1.9 Gm.).
Viola Tricolor. Pansy.	The flowering herb of *Viola tricolor*. It contains a bitter principle, salicylic acid, etc. It is expectorant and alterative, in doses of fifteen to forty grains (0.9 to 2.6 Gm.).

Drugs containing Cathartic Principles, and their Preparations.

SENNA. *U. S.* Senna.

The leaflets of *Cassia acutifolia* Delile (Alexandria Senna), and of *Cassia angustifolia* Vahl (India Senna); (nat. ord. *Leguminosæ*).

Senna contains cathartic acid, which, under the influence of dilute acids and heat, splits into cathartogenic acid and glucose; there are also present phæoretin, sennacrol, catharto-mannite, chrysophan, mucilage, etc. Cathartic acid is believed to be the chief purgative principle, although several of the others possess cathartic properties. When senna leaves are macerated in strong alcohol, the principles which produce griping and give odor and taste are dissolved, whilst the purgative properties are unaffected. Water and diluted alcohol are good solvents for its virtues. The dose of senna is four drachms to one ounce (15.5 to 31 Gm.) when given in infusion.

Official Preparations.

Extractum Sennæ Fluidum . . Fluid Extract of Senna.	Made with a menstruum of diluted alcohol (see page 424). Dose, one to four fluidrachms (3.7 to 14.8 C.c.).
Infusum Sennæ Compositum . Compound Infusion of Senna.	60 Gm. of senna, 120 Gm. each of manna and magnesium sulphate, 20 Gm. of fennel, and 1000 C.c. of boiling water (see page 350). Dose, four fluidounces (118.3 C.c.).
Syrupus Sennæ . . . . Syrup of Senna.	Made by digesting 250 Gm. of senna in 700 C.c. of water, expressing and straining, adding 150 C.c. of alcohol mixed with 5 C.c. of oil of coriander, filtering the mixture, agitating with 700 Gm. of sugar, and adding water to make 1000 C.c. (see page 311).
Confectio Sennæ . . . . Confection of Senna.	Made from 100 Gm. each of senna and tamarind, 160 Gm. of cassia fistula, 70 Gm. of prune, 120 Gm. of fig, 555 Gm. of sugar, 5 Gm. of oil of coriander, and water 500 C.c. (see Confectiones) to make 1000 Gm. Dose, two drachms (7.7 Gm.).

TAMARINDUS. *U. S.* Tamarind.

The preserved pulp of the fruit of *Tamarindus indica* Linné (nat. ord. *Leguminosæ*).

Tamarind belongs to the class of acid saccharine fruits (see page 849), and also to the cathartics. It is laxative, and is used in confection of senna. Copper is sometimes present in the acid pulp, owing to its having been concentrated in copper kettles.

CASSIA FISTULA. *U. S.* Cassia Fistula. [PURGING CASSIA.]

The fruit of *Cassia Fistula* Linné (nat. ord. *Leguminosæ*).

Cassia Fistula yields about 25 per cent. of pulp, which contains pectin, sugar, albuminous principles, salts, etc. The pulp is laxative, and is used in confection of senna.

FICUS. *U. S.* Fig.

The fleshy receptacle of *Ficus Carica* Linné (nat. ord. *Urticaceæ*), bearing fruit upon its inner surface.

Figs contain mucilaginous constituents, sugar, fat, gum, etc. They are nutritious, demulcent, and laxative, and the pulp is used in confection of senna.

PRUNUM. *U. S.* Prune.

The fruit of *Prunus domestica* Linné (nat. ord. *Rosaceæ*).

This fruit contains sugar, malic acid, pectin, salts, etc. The pulp is laxative, and is used in confection of senna.

RHEUM. *U. S.* Rhubarb.

The root of *Rheum officinale* Baillon (nat. ord. *Polygonaceæ*).

Rhubarb contains four resins, which are cathartic in their properties,—*erythroretin, phæoretin, aporetin, emodin.* There are also present chrysophan and chrysophanic acid, both yellow, the former yielding the latter and glucose when treated with diluted acids. The astringent properties of rhubarb are due to *rheo-tannic acid*, $C_{26}H_{26}O_{14}$; *rheumic acid*, $C_{20}H_{16}O_{9}$, and calcium oxalate are also present. The therapeutical properties of rhubarb depend upon the valuable natural combination of its cathartic and astringent constituents. It is given in doses of ten to twenty grains (0.64 to 1.29 Gm.).

Official Preparations.

Extractum Rhei . . . . Extract of Rhubarb.	Made with a menstruum of 4 parts of alcohol and 1 part of water (see page 456). Dose, five to ten grains (0.32 to 0.64 Gm.).
Extractum Rhei Fluidum . . . Fluid Extract of Rhubarb.	Made with a menstruum of 4 parts of alcohol and 1 part of water (see page 418). Dose, twenty minims (1.23 C.c.).
Tinctura Rhei . . . . Tincture of Rhubarb.	Made by percolating 100 Gm. of rhubarb and 20 Gm. of cardamom with a menstruum of 600 C.c. of alcohol, 300 C.c. of water, and 100 C.c. of glycerin, to make 1000 C.c. (see page 376). Dose, one-half to one fluidrachm (1.85 to 3.70 C.c.).
Tinctura Rhei Aromatica . . . Aromatic Tincture of Rhubarb.	Made by percolating 200 Gm. of rhubarb, 40 Gm. each of cinnamon and cloves, and 20 Gm. of nutmeg, with a menstruum of 500 C.c. of alcohol, 400 C.c. of water, and 100 C.c. of glycerin, to make 1000 C.c. (see page 376). Dose, one-half to one fluidrachm (1.85 to 3.70 C.c.).

Official Preparations.—*Continued.*

Tinctura Rhei Dulcis . . . . . Sweet Tincture of Rhubarb.	Made by percolating 100 Gm. of rhubarb, 40 Gm. each of glycyrrhiza and anise, and 10 Gm. of cardamom, with a menstruum of 500 C.c. of alcohol, 400 C.c. of water, and 100 C.c. of glycerin, to make 1000 C.c. (see page 377). Dose, two to three fluidrachms (7.39 to 11 C.c.).
Syrupus Rhei . . . . Syrup of Rhubarb.	Made by mixing 100 C.c. of fluid extract of rhubarb with 4 C.c. of spirit of cinnamon, and 10 Gm. of potassium carbonate dissolved in 50 C.c. of water, then adding 50 C.c. of glycerin, and enough syrup to make 1000 C.c. (see page 308). Dose, one to four fluidrachms (3.70 to 14.8 C.c.).
Syrupus Rhei Aromaticus . . . Aromatic Syrup of Rhubarb.	Made by adding 150 C.c. of aromatic tincture of rhubarb to 850 C.c. of syrup (see page 308).
Mistura Rhei et Sodæ . . . . . Mixture of Rhubarb and Soda.	15 C.c. of fluid extract of rhubarb, 35 Gm. of sodium bicarbonate, 3 C.c. of fluid extract of ipecac, 350 C.c. of glycerin, 35 C.c. of spirit of peppermint, and water to make 1000 C.c. (see page 318). Dose, one to eight fluidrachms (3.70 to 29.57 C.c.).
Pulvis Rhei Compositus . . . . Compound Powder of Rhubarb.	25 Gm. of powdered rhubarb, 65 Gm. of magnesia, and 10 Gm. of ginger. (See Pulveres.) Dose, half a drachm to a drachm (1.94 to 3.88 Gm.).
Pilulæ Rhei . . . . Pills of Rhubarb.	Each pill contains about 3 grains (0.2 Gm.) of rhubarb and 1 grain (0.06 Gm.) of soap.
Pilulæ Rhei Compositæ . . . . Compound Pills of Rhubarb.	Each pill contains about 2 grains (0.13 Gm.) of rhubarb, 1½ grains (0.1 Gm.) of purified aloes, 1 grain (0.06 Gm.) of myrrh, and $\frac{1}{10}$ grain (0.005 C.c.) of oil of peppermint.

CHRYSAROBINUM. *U. S.* Chrysarobin.

A neutral principle (in its commercial more or less impure form), extracted from Goa Powder, a substance found deposited in the wood of *Andira Araroba* Aguiar (nat. ord. *Leguminosæ*).

Chrysarobin is a pale orange-yellow, microcrystalline powder, permanent in the air, odorless and tasteless, almost insoluble in water, only slightly soluble in alcohol, readily soluble in 33 parts of boiling benzol. When heated to 151° C. (303.8° F.) it fuses, forming a dark opaque mass. On ignition it is wholly dissipated. When boiled with about 2000 parts of water (which produces only partial solution), the light reddish-brown filtrate does not affect litmus paper, and is not altered by ferric chloride T.S.

Sulphuric acid dissolves chrysarobin with a deep blood-red color; on pouring the solution into water, the substance separates again unchanged. On adding 0.1 Gm. of chrysarobin to 10 C.c. of potassium or sodium hydrate T.S., in a test-tube, and shaking the latter, the solution, which is at first yellow or yellowish-red, will gradually acquire a deep red color. This is caused by the absorption of oxygen, chrysarobin being converted into chrysophanic acid.

$$\underset{\text{Chrysarobin.}}{C_{30}H_{26}O_7} + \underset{\text{Oxygen.}}{4O} = \underset{\text{Chrysophanic Acid.}}{2C_{15}H_{10}O_4} + \underset{\text{Water.}}{3H_2O}$$

Chrysarobin has been largely used in certain skin diseases, notably psoriasis: it has fallen into disuse mainly on account of the almost indelible stain produced upon the skin and clothing when it is employed. Internally, chrysarobin is cathartic, in the dose of one-sixteenth grain (0.004 Gm.).

Official Preparation.

Unguentum Chrysarobini . Chrysarobin Ointment.	Made by rubbing 5 Gm. of chrysarobin with 95 Gm. of benzoinated lard. (See Unguenta.)

KAMALA. *U. S.* Kamala. [ROTTLERA, PHARM. 1870.]

The glands and hairs from the capsules of *Mallotus philippinensis* (Lamarck) Mueller Arg. (nat. ord. *Euphorbiaceæ*).

Kamala contains *rottlerin*, $C_{22}H_{20}O_6$, nearly 75 per cent. of resins soluble in alcohol, coloring-matter, etc. It is used as a tænifuge and purgative, and is administered in doses of one to three drachms (3.8 to 11.6 Gm.) suspended in mucilage or syrup.

CAMBOGIA. *U. S.* Gamboge.

A gum-resin obtained from *Garcinia Hanburii* Hooker filius (nat. ord. *Guttiferæ*).

Gamboge contains about 75 per cent. of resin called *gambogic acid*, which is dissolved by alkaline solutions, producing a red color; 20 per cent. of gum is present, and this enables gamboge to be emulsified like the other gum-resins. It is a powerful hydragogue cathartic, and is generally used in combination with other substances, which modify its action, as in compound cathartic pills. Dose, one-half to three grains (0.03 to 0.19 Gm.).

JALAPA. *U. S.* Jalap.

The tuberous root of *Ipomœa Jalapa* Nuttall (nat. ord. *Convolvulaceæ*).

Jalap contains from 12 to 20 per cent. of resin, the greater part of which is *convolvulin*, $C_{62}H_{100}O_{32}$, a glucoside insoluble in ether; there are also present gum, sugar, starch, etc. The value of jalap depends exclusively upon the amount of convolvulin present, and the U. S. Pharmacopœia gives the following test of its efficiency: "On exhausting 100 parts of Jalap with alcohol, concentrating the tincture to 40 parts, and pouring it into water, a precipitate of resin should be obtained, which, when washed with water, and dried, should weigh not less than 12 parts, and of which not over 10 per cent. should be soluble in ether."

Jalap is an esteemed cathartic, and is generally used in combination with substances having similar properties. Dose, ten to twenty grains (0.6 to 1.3 Gm.).

Official Preparations.

Extractum Jalapæ . . . . Extract of Jalap.	Made by exhausting jalap with alcohol and evaporating the tincture to a pilular consistence (see page 451). Dose, ten to twenty grains (0.6 to 1.3 Gm.).
Pulvis Jalapæ Compositus . (Pulvis Purgans.) Compound Powder of Jalap.	Made by mixing 35 Gm. of powdered jalap with 65 Gm. of potassium bitartrate. Dose, thirty to sixty grains (1.94 to 3.88 Gm.).
Resina Jalapæ . . . . Resin of Jalap.	Made by exhausting jalap with alcohol, evaporating the tincture, adding it to water, and collecting the precipitated resin (see page 461). Dose, two to five grains (0.13 to 0.32 Gm.).

SCAMMONIUM. *U. S.* Scammony.

A resinous exudation from the living root of *Convolvulus Scammonia* Linné (nat. ord. *Convolvulaceæ*).

Scammony contains from 80 to 90 per cent. of a resin having cathartic properties, called *scammonin*, $C_{34}H_{56}O_{16}$: this is identical with the jalapin obtained from *Ipomœa orizabensis* (see U. S. Dispensatory, p. 757). Scammony is a hydragogue cathartic: it is usually combined with other purgatives. Dose, ten grains (0.64 Gm.).

Official Preparation.

Resina Scammonii . Resin of Scammony.	Made by digesting scammony with boiling alcohol several times, mixing the tinctures, distilling off the alcohol, adding the residue to water, and collecting the precipitate (see page 462). Dose, five grains (0.3 Gm.).

PODOPHYLLUM. *U.S.* Podophyllum. [MAY APPLE.]

The rhizome and roots of *Podophyllum peltatum* Linné (nat. ord. *Berberideæ*).

Podophyllum contains *picropodophyllin*, *podophyllotoxin*, and *podophyllinic acid.* The resinous substances extracted from the powdered rhizome with alcohol contain the purgative principles. It is cholagogue and cathartic, in doses of ten to twenty grains (0.64 to 1.3 Gm.).

Official Preparations.

Extractum Podophylli . . . . . Extract of Podophyllum.	Made with a menstruum of 4 parts of alcohol and 1 part of water (see page 455). Dose, one to three grains (0.06 to 0.19 Gm.).
Extractum Podophylli Fluidum . Fluid Extract of Podophyllum.	Made with a menstruum of 4 parts of alcohol and 1 part of water (see page 417). Dose, five to fifteen minims (0.3 to 0.9 C.c.).
Resina Podophylli . . . . Resin of Podophyllum.	Made by percolating podophyllum with alcohol, distilling the alcohol from the tincture, and pouring the residue into water, cooled to 10° C. (50° F.), containing 1 per cent. of hydrochloric acid (see page 462). Dose, one-eighth to one-half grain (0.008 to 0.03 Gm.).

LEPTANDRA. *U.S.* Leptandra. [CULVER'S ROOT.]

The rhizome and roots of *Veronica virginica* Linné (nat. ord. *Scrophularineæ*).

Leptandra contains a crystalline principle, *leptandrin*,[1] resin, tannin, saponin, gum, mannite, etc. Crystalline leptandrin is bitter, and soluble in water, alcohol, and ether. Leptandra is cholagogue, cathartic, and alterative, in doses of twenty to forty grains (1.3 to 2.6 Gm.).

Official Preparations.

Extractum Leptandræ . . . . . Extract of Leptandra.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 452). Dose, ten grains (0.6 Gm.).
Extractum Leptandræ Fluidum . Fluid Extract of Leptandra.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 412). Dose, twenty minims (1.2 C.c.).

RHAMNUS PURSHIANA. *U.S.* Cascara Sagrada.

The bark of *Rhamnus Purshiana* De Candolle (nat. ord. *Rhamnaceæ*).

This bark contains a neutral, crystallizable principle (probably a glucoside), resins, and tannic, malic, and oxalic acids.

Official Preparation.

Extractum Rhamni Purshianæ Fluidum . Fluid Extract of Rhamnus Purshiana.	Made with a menstruum of diluted alcohol (see page 418). Dose, thirty minims (1.8 C.c.).

FRANGULA. *U.S.* Frangula. [BUCKTHORN.]

The bark of *Rhamnus Frangula* Linné (nat. ord. *Rhamneæ*), collected at least one year before being used.

This bark contains *frangulin*, $C_{20}H_{20}O_{10}$, sometimes called *rhamnoxanthin*, and emodin: both are glucosides. Tannin, resin, and a bitter principle are the other constituents. When frangula is fresh, it is

[1] This must not be confounded with the eclectic leptandrin, which is simply a resin extracted by alcohol.

emetic; when old, it is purgative, tonic, and diuretic. The dose is twenty grains (1.3 Gm.).

Official Preparation.

Extractum Frangulæ Fluidum . Fluid Extract of Frangula.	Made with a menstruum of 5 parts of alcohol and 8 parts of water (see page 406). Dose, twenty minims (1.2 C.c.).

RUMEX. *U. S.* Rumex. [YELLOW DOCK.]

The root of *Rumex crispus* Linné, and of some other species of *Rumex* (nat. ord. *Polygonaceæ*).

This root contains chrysophanic acid (rumicin, lapathin), mucilage, tannin, starch, calcium oxalate, gum, coloring-matter, etc. Alcohol or water extracts its virtues. It is considered to be tonic, alterative, and astringent. Dose, forty to sixty grains (2.6 to 3.9 Gm.).

Official Preparation.

Extractum Rumicis Fluidum . Fluid Extract of Rumex.	Made with diluted alcohol (see page 420). Dose, one fluidrachm (3.7 C.c.).

JUGLANS. *U. S.* Juglans. [BUTTERNUT.]

The bark of the root of *Juglans cinerea* Linné (nat. ord. *Juglandaceæ*), collected in autumn.

Juglans contains *nucin*, $C_{36}H_{12}O_{10}$, fixed oil, volatile oil, tannin, etc. It is cathartic and tonic, in doses of sixty grains (3.9 Gm.).

Official Preparation.

Extractum Juglandis . Extract of Juglans.	Made with diluted alcohol (see page 451). Dose, ten grains (0.6 Gm.).

EUONYMUS. *U. S.* Euonymus. [WAHOO.]

The bark of the root of *Euonymus atropurpureus* Jacquin (nat. ord. *Celastrineæ*).

This bark contains resins, a bitter principle called *euonymin*, *euonic acid*, starch, asparagin, and pectin. Euonymin is cholagogue, cathartic, and tonic. The dose of euonymus is sixty grains (3.9 Gm.).

Official Preparation.

Extractum Euonymi . Extract of Euonymus.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 449). Dose, one to three grains (0.06 to 0.1 Gm.).

ALOE BARBADENSIS. *U. S.* Barbadoes Aloes. [CURAÇAO ALOES.]

The inspissated juice of the leaves of *Aloe vera* (Linné) Webb (nat. ord. *Liliaceæ*).

ALOE SOCOTRINA. *U. S.* Socotrine Aloes.

The inspissated juice of the leaves of *Aloe Perryi* Baker (nat. ord. *Liliaceæ*).

Aloes contains *aloin*, a trace of volatile oil, and a substance which has been improperly called resin. The aloin present in Socotrine aloes is *socaloin*, $C_{15}H_{16}O_7$. This may be distinguished from nataloin and barbaloin by Histed's test, as follows: barbaloin and nataloin are colored bright red by nitric acid; socaloin is not colored red. If nataloin be added to a drop of sulphuric acid on a white porcelain plate and a rod dipped in nitric acid be passed over it, the color changes to blue; with the other aloins no blue color is produced. Aloes is cathartic and emmenagogue. Dose, ten to twenty grains (0.6 to 1.3 Gm.).

Official Preparations.

Extractum Aloes. Extract of Aloes.	Made by dissolving Socotrine aloes in boiling distilled water, cooling, decanting, straining, and evaporating (see page 445). Dose, five to ten grains (0.3 to 0.6 Gm.).
Aloe Purificata. Purified Aloes.	See next article.

ALOE PURIFICATA. *U. S.* Purified Aloes.

	Metric.	Old form.
Socotrine Aloes	1000 Gm.	16 oz. av.
Alcohol	200 C.c.	8 fl. oz.

Heat the Aloes, by means of a water-bath, until it is completely melted. Then add the Alcohol, and, having stirred the mixture thoroughly, strain it through a No. 60 sieve, which has just been dipped into boiling water. Evaporate the strained mixture by means of a water-bath, constantly stirring, until a thread of the mass becomes brittle on cooling. Lastly, break the product, when cold, into pieces of a convenient size, and keep it in well-stoppered bottles.

Purified Aloes is in irregular, brittle pieces of a dull brown or reddish-brown color, and having the peculiar aromatic odor of Socotrine Aloes. It is almost entirely soluble in alcohol.

Aloes, owing to its method of preparation, always contains mechanical impurities,—sand, earth, chips, etc. Alcohol reduces the consistency of the melted aloes so that it can be strained, and it is easily evaporated afterwards. Purified aloes is directed to be used in all the official preparations of the drug. (See preceding article.)

Official Preparations.

Tinctura Aloes. Tincture of Aloes.	Made by macerating 100 Gm. of purified aloes and 200 Gm. of powdered liquorice root in sufficient diluted alcohol to make 1000 C.c. (see page 359). Dose, two to four fluidrachms (7.4 to 14.8 C.c.).
Tinctura Aloes et Myrrhæ. Tincture of Aloes and Myrrh.	Made by macerating 100 Gm. each of purified aloes, myrrh, and liquorice root in a menstruum of 3 parts of alcohol and 1 part of water (see page 360). Dose, one to two fluidrachms (3.7 to 7.3 C.c.).
Pilulæ Aloes. Pills of Aloes.	Each pill contains 2 grains each of purified aloes and soap.
Pilulæ Aloes et Asafœtidæ. Pills of Aloes and Asafetida.	Each pill contains about 1⅓ grains each of purified aloes, asafetida, and soap.
Pilulæ Aloes et Ferri. Pills of Aloes and Iron.	Each pill contains about 1 grain each of purified aloes, dried ferrous sulphate, and aromatic powder, with sufficient confection of rose.
Pilulæ Aloes et Mastiches. Pills of Aloes and Mastic.	Each pill contains about 2 grains of purified aloes and ½ grain each of mastic and red rose.
Pilulæ Aloes et Myrrhæ. Pills of Aloes and Myrrh.	Each pill contains about 2 grains of purified aloes, 1 grain of myrrh, and ½ grain of aromatic powder.

ALOINUM. *U. S.* Aloin.

A neutral principle obtained from several varieties of Aloes, chiefly Barbadoes Aloes (yielding Barbaloin); and Socotra or Zanzibar Aloes (yielding Socaloin),—differing more or less in chemical composition and physical properties according to the source from which it is derived.

Barbaloin may be made by dissolving 1 part of Barbadoes Aloes in 10 parts of boiling water acidulated with hydrochloric acid, and after cooling the liquid is decanted from the resinous matter, evaporated to about 2 parts, and set aside two weeks for crystals to form. The crystals are washed with acetic ether and dried. Socaloin and nataloin are not often found in commerce (see page 956).

Aloinum. U.S.	Odor and Taste.	Solubility. Water.	Alcohol.	Ether.
Minute, acicular crystals, or a microcrystalline powder, varying in color from yellow to yellowish-brown, permanent in the air.	Odorless or possessing a slight odor of aloes; characteristic, bitter taste.	(Barbaloin) 60 parts 15° C. (59° F.). (Socaloin) 60 parts.	(Barbaloin) 20 parts. (Socaloin) 30 parts (absolute).	(Barbaloin) 470 parts. (Socaloin) 380 parts. (9 parts of acetic ether.)

Tests.

When heated, Aloin melts, and, on ignition, it is consumed without leaving a residue.
An alcoholic solution of Aloin is neutral to litmus paper. An aqueous solution of Aloin is colored greenish-black by ferric chloride T.S., and slowly precipitated by basic lead acetate T.S.
On adding a minute portion of Barbaloin to a drop of cold nitric acid of specific gravity 1.200 on a white porcelain surface, a crimson color will be developed. Socaloin will produce scarcely any color when thus treated.
In alkaline solutions, Aloin is rapidly decomposed; in neutral or acid solutions, only slowly.

Uses.—Aloin is used as a cathartic, in doses of two grains (0.13 Gm.). The laxative dose is half a grain (0.03 Gm.).

COLOCYNTHIS. *U.S.* Colocynth.

The fruit of *Citrullus Colocynthis* Schrader (nat. ord. *Cucurbitaceæ*), deprived of its rind.

Colocynth contains *colocynthin*, *colocynthitin*, gum, resin, etc. Colocynthin is a very bitter glucoside, splitting under the action of diluted acids into colocynthein and grape-sugar. The seeds should be rejected. Colocynth is a hydragogue cathartic. Dose, five grains (0.3 Gm.).

Official Preparations.

Extractum Colocynthidis . . . . . . Extract of Colocynth.	Made by percolating colocynth with diluted alcohol, distilling off the alcohol, evaporating the residue to dryness, and reducing the dry mass to powder (see page 447).
Extractum Colocynthidis Compositum Compound Extract of Colocynth.	160 Gm. of extract of colocynth; 500 Gm. of purified aloes; 60 Gm. of cardamom; 140 Gm. each of resin of scammony and soap; 100 C.c. of alcohol (see page 448).

ELATERINUM. *U.S.* Elaterin. $C_{20}H_{28}O_5 = 347.20$.

A neutral principle obtained from Elaterium, a substance deposited by the juice of the fruit of *Ecballium Elaterium* (Linné) A. Richard (nat. ord. *Cucurbitaceæ*).

Preparation.—It may be made by evaporating an alcoholic tincture of elaterium to the consistence of thin oil, and throwing the residue while yet warm into a weak boiling solution of potassa. The potassa holds the green resin in solution, and the elaterin crystallizes as the liquor cools. Or it may be made by exhausting elaterium with chloroform, and adding ether to the solution, which precipitates the elaterin.

Elaterium.—When the fruit of the squirting cucumber is sliced and placed upon a sieve, a perfectly limpid and colorless juice flows out, which soon becomes turbid, and in the course of a few hours begins to deposit a sediment. This, when collected and carefully dried, is very light and pulverulent, of a yellowish-white color, slightly tinged with green, and is called elaterium. The yield is small,—only six grains from

forty cucumbers,—but the elaterium is very powerful, one-eighth of a grain purging violently. Commercial elaterium is not usually made in this way, but by expression or other processes, whereby the yield is increased. The elaterium is, of course, weaker.

Elaterinum. *U. S.*	Tests for Identity.
Minute, white, hexagonal scales or prisms, permanent in the air, odorless, having a slightly bitter, acrid taste and a neutral reaction. Soluble in 4250 parts of water, and in 1820 parts of boiling water; also soluble in 337 parts of alcohol, in 34 parts of boiling alcohol, in 543 parts of ether, and in 2.4 parts of chloroform. At 190° C. (374° F.) the crystals begin to agglutinate, and at about 209° C. (408.2° F.) they melt, forming a yellowish-brown liquid. When ignited, they are consumed without leaving a residue. Elaterin is dissolved by solutions of the alkalies, and reprecipitated on supersaturating with an acid. On dissolving some crystals of Elaterin in melted carbolic acid, and then adding a few drops of strong sulphuric acid, a crimson color will be developed, which soon becomes scarlet.	A solution of Elaterin in cold, concentrated sulphuric acid assumes a yellow color, gradually changing to scarlet. The alcoholic solution of Elaterin should not be precipitated by tannic acid T.S., mercuric chloride T.S., or platinic chloride T.S. (absence of, and difference from, *alkaloids*).

Elaterin is the purgative principle of elaterium. The dose is one-sixteenth of a grain (0.004 Gm.).

Official Preparation.

Trituratio Elaterini . . . 10 Gm. of elaterin are rubbed up with 90 Gm. of sugar of milk.
Trituration of Elaterin. Dose, one-half grain (0.03 Gm.).

BRYONIA. *U. S.* **Bryonia.** [Bryony.]

The root of *Bryonia alba*, and of *Bryonia dioica* Linné (nat. ord. *Cucurbitaceæ*).

Bryonia contains bryonin, a bitter glucoside soluble in alcohol and in water, starch, sugar, resin, etc. Diluted alcohol extracts its virtues. It is used as a hydragogue cathartic, in doses of twenty grains (1.3 Gm.).

Official Preparation.

Tinctura Bryoniæ . . Made by percolating 100 Gm. of bryonia with sufficient alcohol to make 1000 C.c. (see page 362). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).
Tincture of Bryonia.

Drugs containing Astringent Principles, and their Preparations.

GALLA. *U. S.* **Nutgall.**

An excrescence on *Quercus lusitanica* Lamarck (nat. ord. *Cupuliferæ*), caused by the punctures and deposited ova of *Cynips Gallæ tinctoriæ* Olivier (class *Insecta*; order *Hymenoptera*).

Nutgall contains about 50 per cent. of tannin, 2 per cent. of gallic acid, sugar, gum, resin, and starch. It is astringent. Dose, ten to fifteen grains (0.6 to 0.9 Gm.).

Official Preparations.

Tinctura Gallæ . . Made by percolating 200 Gm. of powdered nutgall with a menstruum of 900 C.c. of alcohol and 100 C.c. of glycerin to obtain 1000 C.c. (see page 368). Dose, one fluidrachm (3.7 C.c.).
Tincture of Nutgall.

Unguentum Gallæ . Made by rubbing 20 Gm. of finely powdered nutgall with 80 Gm. of benzoinated lard. (See Unguenta.)
Nutgall Ointment.

ACIDUM TANNICUM. *U. S.* Tannic Acid.

$HC_{14}H_9O_9 = 321.22.$

[GALLOTANNIC ACID. DIGALLIC ACID.]

An organic acid obtained from nutgall.

Preparation.—Tannic acid may be made by the modification of Leconnet's method, which was formerly official, as follows:

Take of Nutgall, in fine powder, Ether, each, a sufficient quantity. Expose the Nutgall to a damp atmosphere for twenty-four hours, and then mix it with sufficient Ether, previously washed with water, to form a soft paste. Set this aside, covered closely, for six hours; then, having quickly enveloped it in a close canvas cloth, express it powerfully between tinned plates, so as to obtain the liquid portion. Reduce the resulting cake to powder, and mix it with sufficient Ether, shaken with one-sixteenth of its bulk of water, to form again a soft paste, and express as before. Mix the liquids, and allow the mixture to evaporate spontaneously until it assumes a syrupy consistence; then spread it on glass or tinned plates, and dry it quickly in a drying closet. Lastly, remove the dry residue from the plates with a spatula, and keep it in a well-stopped bottle.

The explanation of this process is that water and ether form a soluble compound with tannic acid, which may be separated from the nutgall residue by expression; then, by exposing the thick solution to heat, the ether and water are evaporated, leaving the tannic acid in soft, cellular, friable scales upon the plates. Tannic acid, chemically, is an anhydride of gallic acid, thus shown:

$$\underset{\text{Gallic Acid.}}{2C_7H_6O_5} - \underset{\text{Water.}}{H_2O} = \underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9}.$$

Acidum Tannicum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A light yellowish, amorphous powder, usually cohering in form of glistening scales, or spongy masses; gradually darkens on exposure to air and light.	Faint, peculiar odor; strongly astringent taste; acid reaction.	Cold, 1 part. Boiling, Very soluble.	Cold, 0.6 part. Boiling, Very soluble.	In 1 part of glycerin, aided by heat; sparingly in absolute alcohol, freely in diluted alcohol; almost insoluble in absolute ether, chloroform, benzol, and benzin.

Tests.

When heated on platinum foil, it is gradually consumed, leaving not more than 0.2 per cent. of ash. With ferric chloride T.S., an aqueous solution of Tannic Acid forms a bluish-black ink. On adding to an aqueous solution (1 in 100) of Tannic Acid a small quantity of calcium hydrate T.S., a pale bluish-white, flocculent precipitate is produced, which is not dissolved on shaking (difference from *gallic acid*), and which becomes more copious and of a deeper blue by the addition of a moderate excess of calcium hydrate T.S., while a large excess of the latter imparts a pale pinkish tint to the solution.

Uses.—Tannic acid is powerfully astringent, in doses of three to ten grains (0.2 to 0.6 Gm.). Its solution in glycerin is a valuable liquid form of administration.

Official Preparations.

Glyceritum Acidi Tannici . Glycerite of Tannic Acid.	20 Gm. of tannic acid, 80 Gm. of glycerin. Dissolve (see page 319). Dose, ten to forty minims (0.6 to 2.6 C.c.).
Unguentum Acidi Tannici . Ointment of Tannic Acid.	Made by rubbing 20 Gm. of tannic acid with 80 Gm. of benzoinated lard. (See Unguenta.)
Trochisci Acidi Tannici . . Troches of Tannic Acid.	Each troche contains about one grain of tannic acid. (See Trochisci.)

ACIDUM GALLICUM. *U.S.* Gallic Acid.

$HC_7H_5O_5 + H_2O$: 187.55.

An organic acid usually prepared from Tannic Acid.

Preparation.—The former official process may be used for making gallic acid: Take of Nutgall, in fine powder, 36 oz.; Purified Animal Charcoal, Distilled Water, each, a sufficient quantity. Mix the Nutgall with sufficient Distilled Water to form a thin paste, and expose the mixture to the air, in a shallow glass or porcelain vessel, in a warm place, for a month, occasionally stirring it with a glass rod, and adding from time to time sufficient Distilled Water to preserve the semi-fluid consistence. Then submit the paste to expression, and, rejecting the expressed liquor, boil the residue in 8 pints of Distilled Water for a few minutes, and filter while hot through Purified Animal Charcoal. Set the liquid aside that crystals may form, and dry them on bibulous paper. If the crystals be not sufficiently free from color, they may be purified by dissolving them in boiling Distilled Water, filtering through a fresh portion of Purified Animal Charcoal, and again crystallizing.

The present accepted view of the relative chemical positions of tannic and gallic acids—*i. e.*, that tannic acid is an anhydride of gallic acid—seems to be practically confirmed by the above process, the tannic acid of the galls being converted into gallic acid through the continued maceration with water.

$$\underset{\text{Tannic Acid.}}{C_{14}H_{10}O_9} + \underset{\text{Water.}}{H_2O} = \underset{\text{Gallic Acid.}}{2C_7H_6O_5}.$$

Acidum Gallicum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
White or pale fawn-colored solid, crystallizing from water in long, silky, interlaced needles or triclinic prisms, permanent in the air. When heated to 100° C. (212° F.), the crystals lose nearly 9.6 per cent. of combined water; at about 222° C. (431.6° F.) they begin to melt; at a higher temperature they are gradually decomposed; at a low red heat they are completely volatilized.	Odorless; astringent and slightly acidulous taste; acid reaction.	Cold, 100 parts. Boiling, 3 parts.	Cold, 5 parts. Boiling, 1 part.	Absolute ether, 40 parts; glycerin, 12 parts; very slightly soluble in chloroform, benzol, or benzin.

Tests for Identity.

If 5 C.c. of a cold saturated solution of the Acid be treated in a watch-glass with 6 drops of sodium hydrate T.S., a deep green color will gradually be developed. This color is changed to reddish or brownish-red by acids. An aqueous solution of the Acid should not precipitate alkaloids, gelatin, albumen, nor starch T.S. (difference from and absence of *tannic acid*).

TESTS FOR IDENTITY.—*Continued.*

The Acid neither colors nor precipitates pure ferrous salts, but forms a bluish-black precipitate with ferric salts.
On adding to a cold aqueous solution of the Acid some calcium hydrate T.S., a bluish-white precipitate will form, where the test-solution is temporarily in excess, and will disappear on shaking. When the test-solution has been added in excess, the precipitate no longer dissolves, and the liquid acquires a tint which is blue by reflected and green by transmitted light, and becomes pink on the addition of a large excess of calcium hydrate T.S. (distinction from *tannic acid*).

Uses.—Gallic acid is astringent. Dose, five to fifteen grains (0.3 to 0.9 Gm.).

PYROGALLOL. *U. S.* Pyrogallol. [PYROGALLIC ACID.]

$C_6H_3(OH)_3 = 125.7.$

A triatomic phenol obtained chiefly by the dry distillation of gallic acid. Pyrogallic acid should be kept in dark amber-colored bottles.

When gallic acid is sublimed, it is converted by the heat into pyrogallol and carbon dioxide.

$$\underset{\text{Gallic Acid.}}{C_7H_6O_5} = \underset{\text{Pyrogallol.}}{C_6H_6O_3} + \underset{\text{Carbon Dioxide.}}{CO_2}.$$

Pyrogallol. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Light, white, shining laminæ, or fine needles; acquiring a gray or darker tint on exposure to air and light. When heated to 131° C. (267.8° F.), Pyrogallol melts, and may be sublimed unchanged. When ignited, it is consumed, leaving no residue.	Odorless; bitter taste; neutral and faintly acid reaction.	At 15° C. (59° F.), 1.7 parts. Boiling, Very soluble.	At 15° C. (59° F.), 1 part. Boiling, Very soluble.	Soluble in 1.2 parts of ether.

TESTS.

The aqueous solution, which is at first neutral and colorless, gradually acquires, by exposure to the air, a brown color and an acid reaction due to absorption of oxygen. The same change of color takes place very rapidly if the solution contains a caustic alkali.
The aqueous solution (1 in 10) of Pyrogallol reduces solutions of the salts of silver, gold, and mercury, even in the cold.
When freshly prepared, 1 C.c. of the aqueous solution (1 in 20) is colored brownish-red by a few drops of ferric chloride T.S., and this color is changed to a deep bluish-black on the addition of 1 or 2 drops of ammonia water. A bluish-black color is also produced in the aqueous solution of Pyrogallol by freshly prepared ferrous sulphate T.S.

Uses.—Pyrogallol is used in the form of ointment in the treatment of psoriasis, although its use is not without danger; it is also employed in photography.

CATECHU. *U. S.* Catechu.

An extract prepared from the wood of *Acacia Catechu* (Linné fil.) Willdenow (nat ord. *Leguminosæ*).

Catechu contains catechu-tannic acid, a peculiar form of tannin, which is insoluble in ether and turns greenish-black with ferric salts. *Catechin* and *catechol* are also present. Owing to the decomposition of the

tannic acid, the liquid preparations often gelatinize. It is astringent and tonic. Dose, twenty grains (1.3 Gm.).

Official Preparations.

Tinctura Catechu Composita . . Made by percolating 100 Gm. of catechu and 50 Gm. of cassia cinnamon with sufficient diluted alcohol to make 1000 C.c. (see page 364). Dose, one to four fluidrachms (3.7 to 14.8 C.c.).
Compound Tincture of Catechu.

Trochisci Catechu . . . . Each troche contains about 1 grain of catechu.
Troches of Catechu.

KINO. *U. S.* Kino.

The inspissated juice of *Pterocarpus marsupium* Roxburgh (nat. ord. *Leguminosæ*).

Kino contains kino-tannic acid, pyrocatechin, kino red, kinoin, gum, etc. Owing to the decomposition of the kino-tannic acid, the liquid preparations frequently gelatinize. Kino is astringent and tonic. Dose, twenty grains (1.3 Gm.).

Official Preparation.

Tinctura Kino . . . Made by dissolving 100 Gm. of kino in a mixture of 650 C.c. of alcohol, 150 C.c. of glycerin, and 200 C.c. of water, filtering, and washing the filter with enough alcohol to make 1000 C.c. of tincture (see page 370). Dose, one fluidrachm (3.7 C.c.).
Tincture of Kino.

HÆMATOXYLON. *U. S.* Hæmatoxylon. [Logwood.]

The heartwood of *Hæmatoxylon campechianum* Linné (nat. ord. *Leguminosæ*).

Logwood contains *hæmatoxylin*, $C_{16}H_{14}O_6$, a colorless, sweet principle, which is reddened upon exposure to light, and turned blackish-purple upon contact with alkalies, yielding *hæmatëin*, $C_{16}H_{12}O_6.H_2O$; it also contains tannin, resin, etc. It is used largely in the arts for dyeing. Logwood is astringent. Dose, forty grains (2.6 Gm.).

Official Preparation.

Extractum Hæmatoxyli . An aqueous extract made by evaporating the decoction (see page 450). Dose, twenty grains (1.3 Gm.).
Extract of Hæmatoxylon.

KRAMERIA. *U. S.* Krameria. [Rhatany.]

The root of *Krameria triandra* Ruiz et Pavon, and of *Krameria Ixina* Linné (nat. ord. *Polygaleæ*).

Krameria contains about 18 per cent. of kramero-tannic acid, starch, gum, rhatannic red, etc. It is a valuable astringent. Dose, twenty grains (1.3 Gm.).

Official Preparations.

Extractum Krameriæ . . . . . An aqueous extract made with cold water (see page 452). Dose, fifteen grains (0.9 Gm.). Used in making Trochisci Krameriæ. (See Trochisci.)
Extract of Krameria.

Extractum Krameriæ Fluidum . Made with diluted alcohol containing 10 per cent. of glycerin (see page 412). Dose, thirty minims (1.8 C.c.). Used in making Syrupus Krameriæ (see page 307).
Fluid Extract of Krameria.

Tinctura Krameriæ . . . . . . Made by percolating 200 Gm. of krameria with sufficient diluted alcohol to make 1000 C.c. (see page 370). Dose, two fluidrachms (7.4 C.c.).
Tincture of Krameria.

QUERCUS ALBA. *U. S.* White Oak.

The bark of *Quercus alba* Linné (nat. ord. *Cupuliferæ*).

White oak is largely used in tanning leather: it contains about 10 per cent. of tannic acid, with pectin, resin, and brownish-red coloring-matter. It is astringent. Dose, thirty grains (1.9 Gm.).

ROSA GALLICA. *U.S.* Red Rose.

The petals of *Rosa gallica* Linné (nat. ord. *Rosaceæ*), collected before expanding.

Red rose contains *quercitrin* and *quercitannic acid:* the pale red coloring-matter is made bright red by the addition of sulphuric acid. It is slightly astringent and tonic. The infusion of red rose is an elegant vehicle for many substances. (See Part VI.)

Official Preparations.

Extractum Rosæ Fluidum . Fluid Extract of Rose.	Made with diluted alcohol containing 10 per cent. of glycerin (see page 419). Dose, one fluidrachm (3.7 C.c.). Used to make syrup of rose (see page 309).
Mel Rosæ . . . . Honey of Rose.	Made by mixing the fluid extract with clarified honey (see page 313). Used as a flavor.
Confectio Rosæ . . . . . . Confection of Rose.	80 Gm. of red rose, 640 Gm. of sugar, 120 Gm. of clarified honey, and 160 C.c. of stronger rose water. Used as an excipient.

ROSA CENTIFOLIA. *U.S.* Pale Rose.

The petals of *Rosa centifolia* Linné (nat. ord. *Rosaceæ*).

Pale rose petals contain a little tannin, volatile oil, sugar, mucilage, etc. They are used principally on account of their flavor.

OLEUM ROSÆ. *U.S.* Oil of Rose.

A volatile oil distilled from the fresh flowers of *Rosa damascena* Miller (nat. ord. *Rosaceæ.*) It should be kept in well-stoppered vials, in a cool place, protected from light. When dispensed, it should be completely liquefied by warming, if necessary, and well mixed by agitation.

Oil of rose is made in Turkey by distillation. It is used solely as a perfume or flavor.

Oleum Rosæ. U.S.	Odor, Taste, and Reaction.	Solubility.
		Alcohol.
A pale yellowish, transparent liquid. Specific gravity 0.865 to 0.880 at 20° C. (68° F.). The congealing and melting points of the Oil are subject to some variation, depending upon the amount of stearopten, but, when slowly cooled to a temperature, usually, between 16° and 21° C. (60.8° and 69.8° F.), it becomes a transparent solid, interspersed with numerous slender, shining, iridescent, scale-like crystals. Upon the application of the heat of the hand, the crystals should float in the upper portion of the liquefied Oil.	Strong, fragrant odor of rose; mild, slightly sweetish taste; neutral reaction.	Slightly soluble.

Test.
If to 5 drops of the Oil, contained in a test-tube, 5 drops of concentrated sulphuric acid be added, a reddish-brown, thick mixture will be produced, but no white fumes or tarry odor should be developed, and the fragrant odor of the Oil should not be destroyed. If this mixture be shaken with 2 C.c. of alcohol, the resulting liquid may be turbid, but should be nearly colorless, and should not at once assume a red or reddish-brown color (absence of *oil of ginger-grass*, or *Turkish oil of geranium*, from *Andropogon Schœnanthus* Linné (nat. ord. *Gramineæ*), and of *oil of rose geranium*, from *Pelargonium Radula* (Cavanilles) Aiton, *Pelargonium capitatum* (Linné) Aiton, and *Pelargonium odoratissimum* (Linné) Aiton; nat. ord. *Geraniaceæ*).

RHUS GLABRA. *U.S.* Rhus Glabra.

The fruit of *Rhus glabra* Linné (nat. ord. *Anacardieæ*). (See page 848.)

RUBUS. *U. S.* Rubus. [BLACKBERRY.]

The bark of the root of *Rubus villosus* Aiton, *Rubus canadensis* Linné, and *Rubus trivialis* Michaux (nat. ord. *Rosaceæ*).

Rubus owes its astringent properties to tannic acid: there are also present gum, coloring-matter, etc. The dose is twenty grains (0.12 Gm.).

Official Preparation.

Extractum Rubi Fluidum . Fluid Extract of Rubus.	Made with a menstruum consisting of 2 parts of alcohol, 1 part of water, and 10 per cent. of glycerin (see page 420). Dose, a fluidrachm (3.7 C.c.). Used in making Syrupus Rubi (see page 309).

GERANIUM. *U. S.* Geranium. [CRANESBILL.]

The rhizome of *Geranium maculatum* Linné (nat. ord. *Geraniaceæ*).

Geranium contains about 15 per cent. of tannic acid, with brownish-red coloring-matter, starch, sugar, pectin, etc. It is astringent and tonic. Dose, thirty grains (1.9 Gm.).

Official Preparation.

Extractum Geranii Fluidum . Fluid Extract of Geranium.	Made with diluted alcohol containing 10 per cent. of glycerin (see page 407). Dose, a fluidrachm (3.7 C.c.).

HAMAMELIS. *U. S.* Hamamelis. [WITCHHAZEL.]

The leaves of *Hamamelis virginiana* Linné (nat. ord. *Hamamelaceæ*), collected in autumn.

Hamamelis contains tannic acid, chlorophyll, bitter principle, mucilage, etc. It is astringent, slightly hæmostatic, and sedative. Dose, sixty grains (3.9 Gm.).

Official Preparation.

Extractum Hamamelidis Fluidum . Fluid Extract of Hamamelis.	Made with 5 parts of alcohol, 8 parts of water, and 10 per cent. of glycerin (see page 409). Dose, a fluidrachm (3.7 C.c.).

CHIMAPHILA. *U. S.* Chimaphila. [PIPSISSEWA.]

The leaves of *Chimaphila umbellata* (Linné) Nuttall (nat. ord. *Ericaceæ*).

Chimaphila contains about 5 per cent. of tannic acid, with *chimaphilin*, *ericolin*, *arbutin*, *urson*, sugar, gum, etc. It is used as an astringent, diuretic, and tonic, in doses of thirty grains (1.8 C.c.).

Official Preparation.

Extractum Chimaphilæ Fluidum . Fluid Extract of Chimaphila.	Made with diluted alcohol (see page 399). Dose, a fluidrachm (3.7 C.c.).

UVA URSI. *U. S.* Uva Ursi. [BEARBERRY.]

The leaves of *Arctostaphylos Uva-ursi* (Linné) Sprengel (nat. ord. *Ericaceæ*).

Uva ursi contains about 6 per cent. of tannic acid, with gallic acid, *urson*, *arbutin*, *ericolin*, gum, resin, coloring-matter, etc. It is used as a diuretic, astringent, and tonic. Dose, thirty grains (1.9 Gm.).

Official Preparations.

Extractum Uvæ Ursi Fluidum . Fluid Extract of Uva Ursi.	Made with a menstruum of 2 parts of alcohol, 5 parts of water, and 30 per cent. of glycerin (see page 427). Dose, one fluidrachm (3.7 C.c.).
Extractum Uvæ Ursi . . . . . Extract of Uva Ursi.	Made with a menstruum of 2 parts of alcohol and 5 parts of water (see page 457). Dose, five to ten grains (0.3 to 0.6 Gm.).

CASTANEA. *U. S.* Castanea. [CHESTNUT.]

The leaves of *Castanea dentata* (Marshall) Sudworth (nat. ord. *Cupuliferæ*), collected in September or October, while still green.

Chestnut leaves contain tannic acid, mucilage, etc. They are astringent, tonic, and slightly sedative. Dose, thirty grains (1.9 Gm.).

Official Preparation.

Extractum Castaneæ Fluidum. Fluid Extract of Castanea.	Made with boiling water, and contains 20 per cent. of alcohol and 10 per cent. of glycerin, for preservation (see page 399). Dose, two fluidrachms (7.4 C.c.).

SALVIA. *U. S.* Salvia. [SAGE.]

The leaves of *Salvia officinalis* Linné (nat. ord. *Labiatæ*). (See page 863.)

Unofficial Astringent Substances.

Agrimonia. Agrimony.	From *A. Eupatoria*, grown in North America. It contains tannin and bitter principle.
Areca Nut. Semen Arecæ. (Betel Nut.)	Vermifuge. Dose, one to two drachms (3.9 to 7.8 Gm.).
Bistorta. Bistort.	The rhizome of *Polygonum B.*, grown in Canada and the United States. It contains about 20 per cent. of tannin, etc.
Catechu Pallidum. Gambir.	From *Uncaria Gambir*, grown in the East India Islands. It contains catechin, catechutannin, etc.
Comptonia. Sweet Fern.	The leaves of *C. asplenifolia*, found in North America. It contains volatile oil, tannin, etc.
Diospyros. Persimmon.	The bark of *D. virginiana*, grown in the United States. It contains tannin and malic acid.
Epigæa. Trailing Arbutus.	From *E. repens*, found in North America. It contains tannin, and the principles common to the Ericaceæ.
Epilobium. Willow Herb.	From *E. angustifolium*, found in the Northern Hemisphere. It contains tannin, mucilage, etc.
Epiphegus. Beech-drop.	From *E. virginiana*, a parasitic plant found in North America. It contains tannin, bitter principle, etc.
Hepatica. Liverwort.	The leaves of *H. triloba*, found in North America. It contains tannin, mucilage, etc.
Heuchera. Alum-root.	The root of *H. americana*, found in the United States. It contains about 20 per cent. of tannin.
Hieraceum. Hawkweed.	From different species of *Hieraceum*, found in North America. It contains tannin.
Hippocastanum. Horsechestnut Bark.	The bark of *Æsculus Hippocastanum*, grown in North America. It contains tannin and various other principles.
Ilex Paraguayensis. Maté, Paraguay Tea.	The leaves of *I. paraguayensis*, grown in Brazil. It contains 10 to 15 per cent. of caffeine, etc.
Monesia. Monesia.	From *Chrysophyllum glycyphlœum*, found in Brazil. A vegetable extract, alterative and astringent. Dose, from two to ten grains (0.13 to 0.6 Gm.) every hour or two.
Myrobalanus. Myrobalans.	From different species of *Terminalia*, grown in Southern Asia. It contains about 45 per cent. of gallo-tannic acid.
Nymphæa. Water-Lily.	The rhizome of *N. odorata*, found in the United States. It contains tannin and mucilage.
Potentilla. Cinquefoil.	From *P. canadensis*, found in North America. It contains tannin.
Pulmonaria. Lungwort.	From *P. officinalis*, grown in Europe. It contains tannin.
Quercus Tinctoria. Black Oak Bark.	From *Q. coccinea*, var. *tinctoria*, grown in the United States. It contains tannin, etc.
Rhus Aromatica. Sweet Sumach.	From *R. aromatica*. It contains tannin, coloring-matter, gum-resin, etc.
Spiræa. Hardhack.	From *S. tomentosa*, found in North America. It contains tannin and bitter principle.
Statice. Marsh Rosemary.	The root of *S. Limonium*, grown in Europe. It contains tannin and volatile oil.
Tormentilla. Tormentil.	From *T. erecta*, grown in Europe. It contains about 20 per cent. of tannin.

QUESTIONS ON CHAPTER LIX.

DRUGS CONTAINING GLUCOSIDES OR NEUTRAL PRINCIPLES.

What are glucosides?
If salicin is boiled with sulphuric acid, what does it yield?
Explain the reaction which takes place.
How may glucosides be split into glucose and the derived product?
How do these principles act?
How are glucosides usually found?
Gentian—What is the Latin name? Whence is it derived?
What does gentian contain?
Into what does the glucoside gentiopicrin split when heated with dilute acids?
What effect is produced by ferric salts upon preparations of gentian?
To what is this reaction due?
If treated with ferric hydrate, will the preparation still become discolored?
What are the medicinal properties of gentian?
Calumba—What was its former official name?
Whence is it derived, and to what does it owe its virtues?
What other constituents are present?
For what is it used? What are the official preparations?
Quassia—Whence is it derived?
What are its constituents?
To what does it owe its bitterness?
What is the formula in symbols of quassin?
What are its properties? What are the official preparations?
Chirata—Whence is it derived?
What principles does it contain? Give their formulas in symbols.
What are its uses? What are the official preparations?
Salicin—What is the Latin name? Give formula in symbols and molecular weight. What is salicin?
How is it made? Describe odor, taste, chemical reaction, and solubility.
Give tests for identity. What is the dose?
Taraxacum—What is its synonyme? Whence is it derived?
When should it be gathered? What are its constituents?
To what does it owe its bitterness? What is the chemical composition of taraxacin?
What are the official preparations?
Lappa—What is its synonyme? Whence is it derived?
What does it contain? What are its properties?
Scilla—What is its definition? What principles does squill contain?
What are good solvents? What are its properties?
What are the official preparations?
Digitalis—What is its synonyme? What is its definition?
What is digitalin?
Into what is digitoxin converted by the action of diluted acids and heat?
What are its medicinal properties? What are its official preparations?
What does it contain? What is a good solvent? What is the dose?
Spigelia—What is its synonyme? Whence is it derived? What does it contain?
What is a good solvent? What is its use? What are its official preparations?
Cusso—What was the former official name? What is its definition?
What does it contain? For what is it used? What is its official preparation?
Santonica—What is its synonyme? What is its definition?
How much santonin does it contain? What else is in it? What is the dose?
Santonin—What is the Latin name? Give formula in symbols and molecular weight. What is santonin?
How may it be made? Does it combine with alkalies?
What action do acids have upon these solutions?
How may the presence of alkaloids be detected? What is the dose?
Picrotoxin—Give Latin name, formula in symbols, and molecular weight.
What is picrotoxin? How is it made?
Describe taste, odor, chemical reaction, and solubility. Give tests for identity.

What is the dose?
Ergot—What is the Latin name? What is its definition?
What are the constituents of ergot?
To which of these principles does it owe its activity?
What is a good solvent? For what is it used?
What are its official preparations?
Cotton root bark—Whence is it derived?
What are its constituents? What is the dose?
What are its official preparations?
Crocus—Whence is it derived? What glucoside does it contain?
Into what does this glucoside split? What are its other constituents?
What are its medicinal properties? What is the dose?
What are its official preparations?
Red saunders—What is the Latin official name? Whence is it derived?
What does it contain? For what is it used?
Rhus toxicodendron—What is its synonyme?
What do these leaves contain? What is the dose?
Quillaja—What is its synonyme? Whence is it derived?
Where does it come from? What glucoside does it contain?
Into what does this split upon heating with dilute acid?
What are the properties of saponin?
What else does it contain? What are its uses?
Sarsaparilla—Whence is it derived?
What glucoside does it contain?
Into what does this glucoside split when boiled with dilute acids?
What are its other constituents?
What are good solvents? What are its properties?
What are its official preparations?
Senega—Whence is it derived?
What does it contain? What are good solvents?
Why are preparations of senega apt to gelatinize?
How may this be obviated?
What are its properties? In what preparation is it used?
What are its official preparations?
Caulophyllum—What is its synonyme? Whence is it derived?
What does it contain? What is the best solvent?
What are its medical properties?
Senna—Whence is it derived? What does it contain?
Which of these is believed to be the chief purgative principle?
Under the influence of dilute acids and heat, into what does cathartic acid split?
Are the purgative principles soluble in strong alcohol?
What portions are soluble?
What are good solvents for the purgative principles?
What is the dose of senna given in infusion?
What are its official preparations?
Tamarind—What is the Latin name? What is tamarind?
What is its medicinal property?
In what official preparation is it used?
Where does the copper which is sometimes present come from?
Cassia fistula—What is its synonyme?
How much pulp does cassia fistula yield?
What does it contain? In what preparation is it used?
What is its medicinal property?
Fig—What is the Latin official name? What is its definition?
What do figs contain? What are their properties?
Into what official preparation do they enter?
Prune—What is the Latin official name? What does it contain?
What is its property? In what preparation is it used?
Rhubarb—What is the Latin official name? Whence is it derived?
What four cathartic resins does rhubarb contain?
What glucoside does it contain?
Into what does this split when treated with diluted acids?
To what are the astringent properties of rhubarb due?
What other ingredients are present?
Upon what do the medicinal properties of rhubarb depend? What is the dose?

What are the official preparations?
Chrysarobin—What is the Latin name? What is chrysarobin?
Describe its solubility.
At what temperature does it melt?
What color is its solution in alkaline solutions?
What change takes place on exposure to air?
Describe rationale of process.
What action does sulphuric acid have upon it?
What are its properties and uses? What are its official preparations?
Kamala—What is its definition? What was its former official name?
What does it contain? What is the dose?
Gamboge—What is the Latin name? Whence is it obtained?
What does it contain?
What effect have alkaline solutions upon the resin? What is the dose?
Jalap—Whence is it derived?
What glucoside does it contain? What other constituents?
Upon what does the value of jalap depend?
How may its efficiency be tested? What is the dose?
What are the official preparations?
Scammony—What is the Latin name? What is scammony?
What resin does it contain, and how much?
With what other principle is this identical? What is the dose?
What are its official preparations?
Podophyllum—What is its synonyme? Whence is it derived?
What does it contain? What is a good solvent? What is the dose?
What are the official preparations?
Leptandra—What is its synonyme? Whence is it derived?
What does it contain? What is the active principle?
Is this identical with the eclectic preparation leptandrin?
What are the properties of true leptandrin?
Leptandra—What is the dose? What are the official preparations?
Rhamnus Purshiana—Whence is it derived? What are the constituents?
Frangula—Whence is it derived?
What two glucosides does it contain? What other constituents?
What are its properties when fresh? and when old?
What is the dose? What are the official preparations?
Rumex—What is its synonyme? Whence is it obtained?
What does it contain? What are good solvents? What is the dose?
What are the official preparations?
Juglans—What is its synonyme? Whence is it derived?
What does it contain? What is the dose? What are its official preparations?
Euonymus—What is its synonyme? Whence is it derived?
What does it contain? What is the dose? What are its official preparations?
Aloes—What varieties of aloes are official? What are the Latin names? Whence are they derived?
What does aloes contain?
What variety of aloin is present in Socotrine aloes?
How may this be distinguished from barbaloin and from nataloin?
What is the dose? What are the official preparations of Socotrine aloes?
Purified aloes—What is the Latin name? How is it prepared?
What impurities are removed by this process?
What are the official preparations?
Aloin—Whence is it derived? How is it prepared?
What are its medicinal properties?
Colocynth—What is its definition? What glucoside does it contain?
Into what does this glucoside split under the action of diluted acids?
Are the seeds valuable? What is the dose? What are the official preparations?
Elaterin—Give Latin name, symbol, and atomic weight What is elaterin?
How may it be prepared? What is elaterium, and how is it obtained?
What is the yield of elaterium from the cucumber?
How is commercial elaterium usually made? Describe odor, taste, chemical reaction, and solubility.
Give tests for identity. What is the dose? What are the official preparations?
Bryonia—What is its synonyme? Whence is it derived?
What does it contain? What is a good solvent? What is the dose?

What are its official preparations?
Nutgall—What is the Latin name? What are nutgalls?
What do they contain? What is the dose? What are its official preparations?
Tannic acid—What is the Latin official name? Give formula in symbols and molecular weight. What was the former official name?
Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose? What are its official preparations?
Gallic acid—What is the Latin official name? Give formula in symbols and molecular weight. What was the former official name?
Describe rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose? What are its official preparations?
Into what is gallic acid converted when it is sublimed?
Describe rationale of process. For what is pyrogallic acid used?
Catechu—Whence is it derived? What does it contain?
Why do its liquid preparations frequently gelatinize? What is the dose?
What are its official preparations?
Kino—What is it? What does it contain?
Why do its liquid preparations frequently gelatinize? What is the dose?
What are its official preparations?
Hæmatoxylon—What is its synonyme? Whence is it derived?
What does it contain?
What effect do alkalies have upon hæmatoxylin?
What are its medicinal properties? What is the dose?
What are its official preparations?
Krameria—What is its synonyme? Whence is it derived?
What does it contain? What is the dose?
What are its official preparations?
White oak—Whence is it derived?
What does it contain? What is its chief use?
Red rose—What is the Latin official name? Whence is it derived?
What does it contain?
What effect does sulphuric acid have upon the coloring matter?
For what is the infusion used?
What are its medicinal properties? What are its official preparations?
Pale rose—What is the Latin official name? Whence is it derived?
What does it contain? For what is it used?
Oil of rose—What is its synonyme? Whence is it obtained?
What effect does cold have upon it? What is its principal use?
Rhus glabra—Whence is it derived?
Rubus—What is its synonyme? Whence is it derived?
To what does it owe its virtues? What is the dose?
What are its official preparations?
Geranium—What is its synonyme?—What does it contain?
What is the dose? What are its official preparations?
Hamamelis—What is its synonyme? What does it contain?
What is the dose? What are its official preparations?
Chimaphila—What is its synonyme? What does it contain?
What is the dose? What are its official preparations?
Uva ursi—What is its synonyme? Whence is it derived?
What does it contain? What is the dose? What are its official preparations?
Castanea—What is its synonyme? Whence is it derived?
When should the leaves be collected? What do they contain?
What is the dose? What are its official preparations?
Salvia—What is its synonyme? Whence is it derived?

CHAPTER LX.

ALKALOIDS.

THE alkaloids are unquestionably the most important of all the organic compounds which are of interest to the pharmacist, the most active and potent remedies that he dispenses belonging to this class of principles.

Chemically, alkaloids are either *amides* or *amines*.[1] If the former, they are composed of carbon, hydrogen, nitrogen, and oxygen; if the latter, the oxygen is wanting. Alkaloids are obtained from both the vegetable and the animal kingdom. They are found in nearly all the organs of plants, in roots, barks, stems, leaves, petals, seeds, etc. The distinctive features of alkaloids are as follows:

1. They all contain nitrogen. The non-volatile alkaloids (amides) are solids, the volatile alkaloids (amines) are liquids.
2. Alkaloids restore the color of reddened litmus. They combine with acids to form salts, and they are precipitated from their saline solutions upon the addition of alkalies.
3. They are generally the active principles of the plants in which they reside, and are mostly very poisonous or energetic remedies, having a bitter, acrid, or pungent taste.
4. They are mostly crystallizable and colorless, and are insoluble in water, but are soluble in alcohol, chloroform, benzin, benzol, and some in ether. Their salts, on the other hand, are mostly soluble in water, less so in alcohol, but insoluble in chloroform, ether, benzin, and benzol.
5. Alkaloids are mostly precipitated by one or more of the following reagents: potassio-mercuric iodide, auric chloride, tannic acid, phosphomolybdic acid, and picric acid.

The official nomenclature adopted for alkaloids requires that the last syllable shall terminate in *ine:* thus, quinine, morphine, strychnine. The Latin termination is *ina:* as, quinina, morphina, etc. The names of neutral principles and glucosides end in *in:* as, salicin, santonin, gelatin.

OPIUM. *U. S.* Opium.

The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum* Linné (nat. ord. *Papaveraceæ*), and yielding, in its normal, moist condition, not less than *nine per cent.* of crystallized morphine, when assayed. (See process, page 972.)

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[1] Recent researches seem to prove that most alkaloids are derivatives of quinoline or of pyridine in a more or less modified form; many alkaloids are considered to be composed of a basic substance containing all the nitrogen of the alkaloid with a substance which either is an acid or has a neutral composition.

OPII PULVIS. *U. S.* Powdered Opium.

Opium, dried at a temperature not exceeding 85° C. (185° F.), and reduced to a very fine (No. 80) powder.

Powdered Opium, for pharmaceutical or medicinal purposes, when assayed by the process given under Opium, should yield not less than thirteen nor more than fifteen per cent. of crystallized morphine. Any Powdered Opium of a higher percentage may be brought within these limits by admixture with Powdered Opium of a lower percentage, in proper proportions.

Morphiometric Assay.—The proportion of morphine which any particular specimen of opium will furnish may be considered as the best test of its value, except that of an actual trial upon the system. The following is the official process for assaying it:

Opium, in any condition to be valued, *ten grammes*	10 Gm.
Ammonia Water, *three and five-tenths cubic centimeters*	3.5 C.c.
Alcohol,	
Ether,	
Water, each, *a sufficient quantity.*	

Introduce the Opium (which, if fresh, should be in very small pieces, and if dry, in very fine powder) into a bottle having a capacity of about 300 C.c., add 100 C.c. of water, cork it well, and agitate frequently during twelve hours. Then pour the whole as evenly as possible upon a wetted filter having a diameter of 12 Cm., and, when the liquid has drained off, wash the residue with water, carefully dropped upon the edges of the filter and the contents, until 150 C.c. of filtrate are obtained. Then carefully transfer the moist Opium back to the bottle by means of a spatula, add 50 C.c. of water, agitate thoroughly and repeatedly during fifteen minutes, and return the whole to the filter. When the liquid has drained off, wash the residue, as before, until the second filtrate measures 150 C.c., and finally collect about 20 C.c. more of a third filtrate. Evaporate in a tared capsule, first, the second filtrate to a small volume, then add the first filtrate, rinsing the vessel with the third filtrate, and continue the evaporation until the residue weighs 14 Gm. Rotate the concentrated solution about in the capsule until the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 C.c., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 20 Gm. Then add 10 Gm. (or 12.2 C.c.) of alcohol, shake well, add 25 C.c. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during ten minutes, and then set it aside, in a moderately cool place, for at least six hours, or over night.

Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel two rapidly-acting filters, of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 C.c. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 C.c. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 C.c. in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother-water, and afterwards wash them, drop by drop, from a pipette, with alcohol previously saturated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 C.c. or more if necessary. Allow the filter to dry in a moderately warm place, at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass and weigh them.

The weight found, multiplied by 10, represents the percentage of crystallized morphine obtained from the Opium.

OPIUM DEODORATUM. *U. S.* **Deodorized Opium.**

[OPIUM DENARCOTISATUM, PHARM. 1880.]

	Metric.	Old form.
Powdered Opium, containing 13 to 15 per cent. of morphine	100 Gm.	1 oz. av.
Ether	1400 C.c.	14 fl. oz.
Sugar of Milk, recently dried and in fine powder, a sufficient quantity,		
To make	100 Gm.	1 oz. av.

Macerate the Powdered Opium with 700 C.c. [old form 7 fl. oz.] of Ether, in a well-closed flask, during twenty-four hours, agitating from time to time. Pour off the clear, ethereal solution as far as possible, and repeat the maceration with two further portions of Ether, each of 350 C.c. [old form 3½ fl. oz.], first for twelve hours, and the last time for two hours. Collect the residue in a weighed dish, dry it, first by a very gentle heat, and finally at a temperature not exceeding 85° C. (185° F.), and mix it thoroughly, by trituration, with enough Sugar of Milk to make the product weigh 100 Gm. [old form 1 oz. av.].

Opium owes its value to the narcotic alkaloids present in it. Nineteen alkaloids have been proved to exist in various kinds of opium, and several more have been announced, but their existence has not been certainly confirmed. Two acids are found in opium combined with the alkaloids,—*i.e.*, meconic and lactic acids; there are also present *meconin*, $C_{10}H_{10}O_4$, *meconoiosin*, $C_8H_{10}O_2$, both neutral principles, pectin, glucose, mucilage, caoutchouc, wax, and odorous, fatty, and coloring matters. *Meconic acid* is colored red by ferric salts, the color not being discharged by solution of mercuric chloride. A solution of potassium sulphocyanide is colored in a similar manner, but it is rendered colorless by solution of mercuric chloride. The alkaloids are as follows:

Morphine, $C_{17}H_{19}NO_3.H_2O$. The chief principle, and the first alkaloid discovered (see separate article, page 975).

Codeine, $C_{18}H_{21}NO_3$. An important narcotic alkaloid (see page 979).

Narcotine, $C_{22}H_{23}NO_7$. An alkaloid discovered and named by Derosne in 1803, and erroneously supposed to be the narcotic principle. It is white, tasteless, and inodorous, and crystallizes in silky flexible needles, usually larger than the crystals of morphine, fusible at 115.5° C. (240° F.) and volatilizable at 154.4° C. (310° F.), insoluble in cold water, soluble in 400 parts of boiling water, in 100 parts of cold alcohol, and in 24 parts of boiling alcohol, which deposits it upon cooling, and very soluble in ether. It is colored red by a mixture of sulphuric and nitric acids. It is *not narcotic*, but is said to be antiperiodic.

Thebaine (Paramorphine), $C_{19}H_{21}NO_3$, is white, crystallizable, of an acrid and styptic rather than bitter taste, fusible at about 98.8° C. (210° F.) and volatilizable at 160° C. (320° F.), scarcely soluble in water, very soluble in alcohol and ether when cold, and still more so when heated. Alkalies precipitate it from its acid solutions, and, unless in very concentrated solution, do not dissolve it when added in excess. Unlike morphine, it is not reddened by nitric acid, nor does it become blue with solutions of ferric salts. It is colored red by a mixture of sulphuric and nitric acids. It is not narcotic, but in its effects on the

system is closely analogous to strychnine, producing tetanic spasms in the dose of a grain (0.06 Gm.).

Papaverine, $C_{21}H_{21}NO_4$, is crystallizable in needles, fusible at 98.8° C. (210° F.) and volatilizable at 154.4° C. (310° F.). It is insoluble in water, very sparingly soluble in cold alcohol or ether, more soluble in these liquids boiling hot, and deposited by them on cooling, soluble in benzol and chloroform. It is colored dark blue by sulphuric acid, changing to green if a crystal of potassium nitrate be added to it. It is narcotic.

Narceine, $C_{23}H_{29}NO_9$, is in white, silky crystals, inodorous, of a bitter taste, fusible at 76.6° C. (170° F.) and volatilizable at 215.5° C. (420° F.), soluble in 375 parts of cold and 220 of boiling water, soluble also in alcohol, and insoluble in ether. It forms a bluish compound with a little iodine, the color of which is destroyed by heat and the alkalies. It is rendered blue by the action of mineral acids so far diluted as not to decompose it; but, unlike morphine, it does not become blue by the action of ferric salts, nor red by that of nitric acid. Narceine is narcotic, and may be given in doses of one-third to one-half of a grain (0.02 to 0.03 Gm.).

Hydrocotarnine, $C_{12}H_{15}NO_3$, is soluble in alcohol, acetone, chloroform, benzin, and ether. It melts at 50° C. (122° F.), and loses at a somewhat greater heat the molecule of water with which it crystallizes. Sulphuric acid dissolves it, coloring it yellow in the cold, and crimson-red if heated. Nitric acid colors it yellow; ferric chloride does not affect its color.

Pseudomorphine, $C_{17}H_{19}NO_4$, possesses two properties of morphine: it dissolves in concentrated nitric acid with an intense orange-red, and in solution of ferric chloride with a blue color.

Cryptopine, $C_{21}H_{23}NO_5$, produces a blue color with sulphuric acid; it is but slightly soluble in water or alcohol. It is narcotic.

Protopine, $C_{20}H_{19}NO_5$, is insoluble in water, soluble in alcohol and chloroform.

Laudanine, $C_{20}H_{25}NO_4$. Colored red by sulphuric acid, a reddish-violet when heated.

Codamine, $C_{20}H_{25}NO_4$. Isomeric with laudanine; colored green with nitric acid and ferric chloride.

Rhœadine, $C_{21}H_{21}NO_6$. Nearly insoluble in water, alcohol, ether, benzin, and chloroform; with sulphuric acid it turns a purple color.

Meconidine, $C_{21}H_{23}NO_4$. Amorphous; easily soluble in alcohol, ether, benzol, and chloroform; colored olive-green by sulphuric acid, orange-red by nitric acid.

Laudanosine, $C_{21}H_{27}NO_4$. Produces rose color with sulphuric acid, violet when heated; soluble in ether.

Lanthopine, $C_{23}H_{25}NO_4$. Easily soluble in chloroform, sparingly in alcohol, ether, or benzol.

Gnoscopine, $C_{34}H_{36}N_2O_{11}$. Crystallizable; soluble in chloroform, carbon disulphide, and benzol, but not in ether.

Deuteropine, $C_{20}H_{21}NO_5$. Similar to cryptopine.

Oxynarcotine, $C_{22}H_{23}NO_8$. Nearly insoluble in water, alcohol, chloroform, and benzol, but soluble in alkaline solutions.

Uses.—Opium is narcotic, sedative, and antispasmodic. The dose is one grain (0.06 Gm.).

Official Preparation of Opium.

Pulvis Opii . . . . Powdered Opium.	In No. 50 powder, 8 grains represent about 12 grains of opium.

Official Preparations of Powdered Opium.

Opium Deodoratum . . . . . . Deodorized Opium.	See page 973.
Acetum Opii . . . . Vinegar of Opium.	Made by macerating and percolating 100 Gm. of powdered opium, 30 Gm. of nutmeg, and 200 Gm. of sugar, with sufficient diluted acetic acid to make 1000 C.c. (see page 436). Dose, twelve minims (0.7 C.c.).
Extractum Opii . . . . Extract of Opium.	An aqueous extract. 1 grain represents about 2 grains of opium. Dose, one-half grain (0.03 Gm.) (see page 454)[1]
Tinctura Opii . . . . Tincture of Opium.	Made by macerating and percolating 100 Gm. of powdered opium and 50 Gm. of precipitated calcium phosphate with sufficient diluted alcohol to make 1000 C.c. (see page 373). Dose, twelve minims (0.7 C.c.).
Tinctura Opii Deodorati . . . . Tincture of Deodorized Opium.	Made by macerating and percolating 100 Gm. of powdered opium and 50 Gm. of precipitated calcium phosphate with 400 C.c. of water, expressing, repeating, mixing the expressed liquids, evaporating to 100 C.c., agitating with 200 C.c. of ether to dissolve the narcotine and odorous principles, separating the liquids, evaporating the aqueous portion, filtering, and adding sufficient water to make 800 C.c., then adding 200 C.c. of alcohol (see page 374). Dose, twelve minims (0.7 C.c.).
Tinctura Opii Camphorata . . . Camphorated Tincture of Opium.	Made by macerating and percolating 4 Gm. each of powdered opium, benzoic acid, camphor, and 4 C.c. of oil of anise, with 40 C.c. of glycerin, and sufficient diluted alcohol to make 1000 C.c. (see page 374). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).
Vinum Opii . . . . Wine of Opium.	Made by macerating and percolating 100 Gm. of powdered opium and 10 Gm. each of cassia cinnamon and cloves, with 150 C.c. of alcohol and 850 C.c. of white wine, to make 1000 C.c. (see page 383). Dose, twelve minims (0.7 C.c.).
Pilulæ Opii . . . . Pills of Opium.	Each pill contains 1 grain of powdered opium and ½ grain of soap. (See Pilulæ.)
Pulvis Ipecacuanhæ et Opii . . Powder of Ipecac and Opium.	10 Gm. each of powdered opium and ipecac, and 80 Gm. of sugar of milk. (See Pulveres, also Tincture of Ipecac and Opium.)
Trochisci Glycyrrhizæ et Opii . Troches of Glycyrrhiza and Opium.	Each troche contains about $\frac{1}{12}$ grain of powdered opium and 2½ grains of extract of glycyrrhiza. (See Trochisci.)

Official Preparation of Extract of Opium.

Emplastrum Opii . . . . Opium Plaster.	60 Gm. of extract of opium, 180 Gm. of Burgundy pitch, 760 Gm. of lead plaster, and 80 C.c. of water, to make 1000 Gm. (See Emplastra.)

MORPHINA. *U. S.* Morphine.

$C_{17}H_{19}NO_3 + H_2O$; 302.34.

An alkaloid obtained from Opium.

Morphine was the first alkaloid to be discovered. The credit of its isolation belongs to Sertürner, an apothecary of Eimbeck, Germany, who announced its presence in opium in 1817, and named it *morphium.*

Preparation.—Morphine may be prepared by the former official process, as follows:

Take of Opium, sliced, 12 oz. troy; Water of Ammonia, 6 fl. oz.; Animal Charcoal, in fine powder, Alcohol, Distilled Water, each, a suf-

ficient quantity. Macerate the Opium with 4 pints of Distilled Water for twenty-four hours, and, having worked it with the hand, again macerate for twenty-four hours, and strain. In like manner, macerate the residue twice successively with the same quantity of Distilled Water, and strain. Mix the infusions, evaporate to 6 pints, and filter; then add 5 pints of Alcohol, and afterwards 3 fl. oz. of the Water of Ammonia, previously mixed with 8 fl. oz. of Alcohol. After twenty-four hours, pour in the remainder of the Water of Ammonia, mixed, as before, with 8 fl. oz. of Alcohol; and set the liquid aside for twenty-four hours that crystals may form. To purify these, boil them with 2 pints of Alcohol until they are dissolved, filter the solution, while hot, through Animal Charcoal, and set it aside to crystallize.

In this process the infusions containing the morphine, in combination with meconic and lactic acids, are treated with alcohol and water of ammonia: the former retains the coloring-matter, caoutchouc, resins, etc., in solution, whilst the ammonia combines with the natural acids, the morphine being precipitated as an insoluble precipitate.

Morphina. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless or white, shining, prismatic crystals or fine needles, or a crystalline powder, permanent in the air. When heated to about 75° C. (167° F.), Morphine begins to lose its water of crystallization. Heated for some time at 100° C. (212° F.), it becomes anhydrous. At 254° C. (489.2° F.) it melts, forming a black liquid. Upon ignition it is consumed without leaving a residue.	Odorless; bitter taste; alkaline reaction.	At 15° C. (59° F.), 4350 parts. Boiling, 455 parts.	Cold, 300 parts. Boiling, 36 parts.	Soluble in 4000 parts of ether.

Tests.

When crystals of Morphine are sprinkled upon nitric acid (specific gravity 1.250 to 1.300), they will assume an orange-red color. On shaking a small portion of Morphine in a test-tube with 10 C.c. of chlorine water, the latter will acquire a yellowish color. On now carefully pouring a small amount of ammonia water on the surface of the liquid, a brown or reddish-brown zone will form at the line of contact of the two liquids. If to a neutral 1-per-cent. solution of Morphine, made by the careful addition of dilute sulphuric acid, a few drops of ferric chloride T.S. be added, a blue color will be produced, which is destroyed by acids, alcohol, or heating.	More than traces of Narcotine, Papaverine, etc.	On treating Morphine with cold, concentrated sulphuric acid free from nitric acid, the liquid should not at once acquire more than a faintly yellowish tinge,
	Difference from Strychnine.	And the subsequent addition of a small crystal of potassium permanganate should produce only a greenish, but no violet or purple, color.
	Absence of Narcotine, Codeine, etc.	On precipitating the solution of any of the salts of Morphine by ammonia water, dissolving the washed precipitate in sodium hydrate T.S., shaking the solution with an equal volume of ether, and evaporating the ethereal solution, no appreciable residue should remain.
	Absence of, and difference from, various other Alkaloids.	On adding 4 C.c. of potassium or sodium hydrate T.S. to 0.2 Gm. of Morphine, a clear, colorless solution, free from any undissolved residue, should result.

Uses.—Morphine is rarely used medicinally, its salts—the sulphate, acetate, hydrochlorate, etc.—being preferred because of their solubility in water.

MORPHINÆ ACETAS. *U. S.* Morphine Acetate.

$$C_{17}H_{19}NO_3C_2H_4O_2 + 3H_2O = 398.12.$$

Preparation.—This salt may be made by the former official process, as follows:

Take of Morphine, in fine powder, 1 oz. troy; Distilled Water 8 fl. oz.; Acetic Acid a sufficient quantity. Mix the Morphine with the Distilled Water; then carefully drop Acetic Acid into the mixture, stirring it constantly until the Morphine is neutralized and dissolved. Evaporate the solution, by means of a water-bath, to the consistence of syrup, and set aside until it concretes. Lastly, dry the salt with a gentle heat, and rub it into powder.

Care is required not to employ too much heat in the evaporation, as the acetate is easily decomposed, a portion of the acetic acid escaping and leaving an equivalent portion of uncombined morphine.

The salt itself is subject to loss of acetic acid, and this may be discovered upon attempting to make a solution. When turbidity results, due to the inability of the water to dissolve the alkaloid, a few drops of acetic acid are needed to make the solution perfect.

Morphinæ Acetas. *U. S.*	Tests.
A white or faintly yellowish-white, crystalline or amorphous powder, slowly losing acetic acid when exposed to the air, having a faintly acetous odor, a bitter taste, and a neutral or faintly alkaline reaction. When freshly prepared, the salt is soluble in 2.5 parts of water and in 47.6 parts of alcohol at 15° C. (59° F.). On protracted exposure to the air, the salt gradually loses some acetic acid, and becomes less soluble. It is also soluble in 1.5 parts of boiling water, in 14 parts of boiling alcohol, in 60 parts of boiling chloroform, in about 1700 parts of ether, and in 2100 parts of cold chloroform.	When heated, the salt loses water as well as acetic acid. Upon ignition, it is consumed, leaving no residue. The addition of potassium or sodium hydrate T.S. to an aqueous solution of the salt causes a white precipitate, which is soluble in an excess of the alkali, and which conforms to the reactions and tests of Morphine (see Morphina). On adding sulphuric acid to the salt, vapors of acetic acid are evolved.

Uses.—Morphine acetate is narcotic and sedative. Dose, one-eighth of a grain (0.008 Gm.).

MORPHINÆ HYDROCHLORAS. *U. S.* Morphine Hydrochlorate.

$$C_{17}H_{19}NO_3HCl + 3H_2O = 374.63.$$

Preparation.—This salt may be prepared by a process similar to that used for making morphine acetate (see preceding article), by substituting hydrochloric acid for acetic acid. It is a more stable salt than the acetate.

Morphinæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, feathery needles of a silky lustre, or minute, colorless, needle-shaped crystals, permanent in the air. When heated to 100° C. (212° F.), the salt loses its water of crystallization (14.38 per cent.). At 300° C. (572° F.) it coheres slightly, but does not completely melt; and upon ignition it is consumed, leaving no residue.	Odorless; bitter taste; neutral reaction.	At 15° C. (59° F.), 24 parts. Boiling, 0.5 part.	Cold, 62 parts. Boiling, 31 parts.	Very slightly soluble in ether or chloroform.

Tests.
Solution of potassium or sodium hydrate T.S. added to an aqueous solution of the salt throws down a white precipitate, which is soluble in an excess of the alkali. The precipitate is affected by reagents in the same manner as morphine. (See Morphina.) The aqueous solution yields, with silver nitrate T.S., a white precipitate, insoluble in nitric acid.

Uses.—Morphine hydrochlorate is used very largely in Great Britain as a narcotic and sedative. The dose is one-eighth of a grain (0.008 Gm.).

MORPHINÆ SULPHAS. *U. S.* Morphine Sulphate.

$$(C_{17}H_{19}NO_3)_2H_2SO_4 + 5H_2O = 756.88.$$

Preparation.—This useful salt may be made by the former official process, as follows:

Take of Morphine, in fine powder, 1 oz. troy; Distilled Water 8 fl. oz.; Diluted Sulphuric Acid a sufficient quantity. Mix the Morphine with the Distilled Water, then carefully drop in Diluted Sulphuric Acid, constantly stirring until the Morphine is neutralized and dissolved. Evaporate the solution, by means of a water-bath, so that on cooling it may crystallize. Lastly, drain the crystals, and dry them on bibulous paper.

Morphinæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
White, feathery, acicular crystals of a silky lustre, permanent in the air. When heated for some time at 100° C. (212° F.), the salt loses 3 molecules (7.12 per cent.) of water of crystallization; the remaining two molecules (4.75 per cent.) are gradually expelled by raising the temperature to 130° C. (266° F.). At 255° C. (491° F.) the salt melts, and upon ignition it is consumed, leaving no residue.	Odorless; bitter taste; neutral reaction.	At 15° C. (59° F.), 21 parts. Boiling, 0.75 part.	At 5° C. (59° F.), 702 parts. Boiling, 144 parts.	Almost insoluble in ether.

Tests for Identity.
Solution of potassium or sodium hydrate T.S. added to an aqueous solution of the salt throws down a white precipitate, which is soluble in an excess of the alkaii. The precipitate is affected by reagents in the same manner as morphine. (See Morphina.) The aqueous solution yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid.

Uses.—Morphine sulphate is much more largely employed in the United States than any other salt of morphine: the dose is one-eighth of a grain (0.008 Gm.). The *solution of sulphate of morphine* formerly official was made by dissolving one grain of morphine sulphate in one fluidounce of distilled water: although the solution is more stable than that of any other of the morphine salts in use, it will in time become deteriorated, either through the presence of microscopic plants or from other causes, and hence it is not desirable to keep it on hand. This solution must not be confounded with *Magendie's solution*, which is *sixteen times as strong,—i.e.*, sixteen grains in a fluidounce. This solution is often used hypodermically.

Official Preparations.

Pulvis Morphinæ Compositus . . . . Compound Powder of Morphine.	Made by mixing 1 Gm. of morphine sulphate with 19 Gm. of powdered camphor and 20 Gm. each of glycyrrhiza and precipitated calcium carbonate. (See Pulveres.) Dose, ten grains (0.6 Gm.).
Trochisci Morphinæ et Ipecacuanhæ . Troches of Morphine and Ipecac.	Each troche contains $\frac{1}{40}$ grain of morphine sulphate and $\frac{1}{12}$ grain of ipecac. (See Trochisci.)

CODEINA. *U.S.* Codeine.

$$C_{18}H_{21}NO_3 + H_2O = 316.31.$$

An alkaloid obtained from Opium.

When the solution of the mixed morphine and codeine hydrochlorates is treated with ammonia, the former alkaloid is precipitated, and the codeine, remaining in solution, may be obtained by evaporation and crystallization. It may be purified by treating the crystals with hot ether, which dissolves them, and yields the codeine in colorless crystals on spontaneous evaporation.

Codeine is remarkable for being the most soluble alkaloid in use, there being no necessity for salifying it. It is usually seen in larger crystals than any other alkaloid.

Codeina. U.S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
White, more or less translucent, orthorhombic prisms, or octohedral crystals, somewhat efflorescent in warm air. When heated to 100° C. (212° F.), Codeine loses its water of crystallization (5.67 per cent.). At about 155° C. (311° F.) it melts, forming a colorless liquid, and on ignition it is completely dissipated. If 0.1 Gm. of Codeine be dissolved in 6 C.c. of cold, concentrated sulphuric acid (free from nitrose), the resulting liquid should be colorless. If about 2 C.c. of this solution be poured into a small porcelain capsule, and 1 drop of highly diluted nitric acid (made by adding 1 drop of nitric acid to 200 C.c. of water) added, a bluish-red tint gradually changing to pale blue will be developed.	Odorless; slightly bitter taste; alkaline reaction.	At 15° C. (59° F.), 80 parts. Boiling, 17 parts.	Cold, 3 parts. Boiling, Very soluble.	In 2 parts of chloroform; also soluble in 30 parts of ether.

Tests for Identity and Purity.
Another portion of the same solution, of about 2 C.c., gently warmed, and mixed with 1 drop of a mixture of 1 volume of ferric chloride T.S. and 19 volumes of water, likewise assumes a bluish or blue tint (difference from *morphine*).
On adding to 5 C.c. of an aqueous solution of Codeine (1 in 100) 10 drops of bromine water, and shaking so as to redissolve the precipitate formed, the liquid will gradually develop a light claret-red tint. This tint may be developed at once by the addition of ammonia water.
On sprinkling 0.05 Gm. of Codeine upon 2 C.c. of nitric acid (specific gravity 1.200), the crystals will turn red, but the acid, even when warmed, will acquire only a yellow color (difference from and absence of *morphine*).

Uses.—Codeine is sedative, in doses of one-fourth to one grain (0.016 to 0.06 Gm.).

APOMORPHINÆ HYDROCHLORAS. *U. S.* **Apomorphine Hydrochlorate.**

$C_{17}H_{17}NO_2HCl$; 302.79.

The hydrochlorate of an artificial alkaloid prepared from morphine or codeine. It should be kept in small, dark amber-colored vials.

Preparation.—It may be made by heating morphine in a closed tube with a great excess of hydrochloric acid for two or three hours to the temperature of 140°–150° C. (284°–302° F.). The contents of the tube are then dissolved in water, an excess of sodium bicarbonate added, and the precipitate exhausted with ether or chloroform. On the addition to the solution of a very small quantity of hydrochloric acid, crystals of apomorphine hydrochlorate form. The process is one of dehydration,—the morphine parting with one molecule of water, thus:

$$\underset{\text{Morphine.}}{C_{17}H_{19}NO_3} - \underset{\text{Water.}}{H_2O} = \underset{\text{Apomorphine.}}{C_{17}H_{17}NO_2}.$$

Apomorphinæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Minute, grayish-white, shining, acicular crystals, turning greenish on exposure to light and air. The crystals are colored blood-red to orange by nitric acid, transiently violet to light brown by sulphuric acid, dark purple to orange by a mixture of these acids.	Odorless; faintly bitter taste; neutral reaction.	At 15° C. (59° F.), 45 parts. Boiling, Slowly decomposed.	Cold, 45 parts. Boiling, Slowly decomposed.	Almost insoluble in ether or chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
At 270° C. (518° F.) it fuses to a black mass, and when ignited it is consumed without leaving a residue. Addition of silver nitrate T.S. to an aqueous solution of the salt produces a white precipitate insoluble in nitric acid, but instantly reduced by ammonia water. On shaking a few C.c. of the saturated, aqueous solution of the salt with a few small particles of manganese dioxide, the liquid acquires a green color, which is turned reddish-brown by adding some crystals of oxalic acid. If the oxalic acid be added to the solution first, and then a few small particles of manganese dioxide, the liquid will, upon agitation, assume a deep brownish-red color.	Morphine.	Addition of sodium bicarbonate solution to the aqueous solution throws down the white amorphous alkaloid, which soon turns green on exposure to air, and imparts a violet or blue color to chloroform, in which it is very soluble.
	Water.	If the salt impart, at once, an emerald-green color to 100 parts of water on being shaken with it a few times in a test-tube, it should be rejected.

Uses.—This remarkable compound is devoid of narcotic properties, but is powerfully emetic. The dose is one-fourth grain (0.016 Gm.), or, hypodermically, one-tenth grain (0.007 Gm.).

CINCHONA. *U. S.* Cinchona.

The bark of *Cinchona Calisaya* Weddell, *Cinchona officinalis* Linné, and of hybrids of these and of other species of *Cinchona* (nat. ord. *Rubiaceæ*), yielding, when assayed by the process given below, not less than 5 per cent. of total alkaloids, and at least 2.5 per cent. of quinine ($C_{20}H_{24}N_2O_2 + H_2O = 341.8$).

CINCHONA RUBRA. *U. S.* Red Cinchona.

The bark of *Cinchona succirubra* Pavon (nat. ord. *Rubiaceæ*), containing not less than 5 per cent. of its peculiar alkaloids.

The value of cinchona bark depends entirely upon the percentage of alkaloids present in it; and, as barks are found in the market greatly varying in quality, it is necessary to prove their worth by assay.

Assay of Cinchona. *U. S.*

I. For Total Alkaloids.

Cinchona, in No. 80 (or finer) powder, and completely dried at 100° C. (212° F.), *twenty grammes* . . . . **20 Gm.**
Alcohol,
Ammonia Water,
Chloroform,
Ether,
Normal Sulphuric Acid (V.S.),
Potassium Hydrate V.S., each, *a sufficient quantity.*

To 20 Gm. of Cinchona, in very fine powder, and contained in a bottle provided with an accurately ground glass stopper, add 200 C.c. of a previously prepared mixture of 19 volumes of alcohol, 5 volumes of chloroform, and 1 volume of ammonia water, stopper the bottle, and shake it thoroughly and frequently during four hours. Then separate the liquid by pouring it into another bottle through a funnel containing a pellet of cotton, in such a manner that no material loss by evaporation may result. Transfer 100 C.c. of the clear filtrate (representing 10 Gm. of Cinchona) to a beaker, and evaporate it to dryness. Dissolve the residue of crude alkaloids thus obtained in 10 C.c. of water and 4 C.c. of normal sulphuric acid, with the aid of a gentle heat, filter the cooled solution into a separatory funnel, and wash the beaker and filter until the filtrate no longer has an acid reaction, using as small a quantity of water as possible. Now add 5 C.c. of potassium hydrate V.S., or such an amount as will render the liquid decidedly alkaline, and extract the alkaloids by shaking the mixture, first with 20 C.c., and then repeatedly with 10 C.c. of chloroform, until a drop of the last chloroform extraction, when evaporated on a watch-glass, no longer leaves a residue. Evaporate the united chloroformic extracts in a tared beaker, dry the residue at 100° C. (212° F.), and weigh. The weight found, multiplied by *ten* (10), will give the percentage of *total alkaloids* in the specimen of Cinchona tested.

II. For Quinine.

Transfer 50 C.c. of the clear filtrate remaining over from the preceding process (and representing 5 Gm. of Cinchona) to a beaker, evaporate it to dryness, and proceed as directed in the assay for total alkaloids, using, however, only one-half the amounts of volumetric acid and alkali there directed. Add the united chloroformic extracts containing the alkaloids in solution, gradually, and in small portions at a time, to about 5 Gm. of powdered glass contained in a porcelain capsule placed over a water-bath, so that, when the contents of the capsule are dry, all or nearly all of the dry alkaloids shall be in intimate admixture with the powdered glass, and the chloroform be completely expelled. Now moisten the residue with ether, and, having placed a funnel containing a filter of a diameter of 7 Cm., and well wetted with ether, over a small graduated tube (A), transfer to the filter the ether-moistened residue from the capsule. Rinse the latter several times, if necessary, with fresh ether,

so as to transfer the whole of the residue to the filter, then percolate with ether added drop by drop, until exactly 10 C.c. of percolate have been obtained. Then collect another volume of 10 C.c., by similar, slow percolation with ether, in a second graduated tube (B). Transfer the contents of the two tubes completely (using ether for washing) to two small, tared capsules, properly marked (A and B) so as to avoid confusion, evaporate to a constant weight at 100° C. (212° F.), and weigh them. (The residue in A will contain practically all the quinine, together with a portion of the alkaloids less soluble in ether; the residue in B will consist almost entirely of these alkaloids.) From the amount of residue obtained in capsule A deduct that contained in B, and multiply the remainder by *twenty* (20). The product will represent, approximately, the percentage of *quinine* (containing 1 molecule of water) in the specimen of Cinchona tested.

About twenty alkaloids have been discovered in cinchona barks. Some of these are found in only one kind of bark, some are doubtless "split products,"—that is, not existing naturally in the bark, but the result of the action of chemical agents upon it.

Quinine, Quinidine, Cinchonine, and *Cinchonidine* are the most important alkaloids found in cinchona barks, and they, or their important salts, will be considered in separate articles. The acids present are *kinic,* or *quinic, cinchotannic,* and *kinovic,* or *quinovic.* The neutral principle is *kinovin,* or *quinovin,* whilst *cinchonic red,* volatile oil, and red and yellow coloring-matter are also present. The first four of the alkaloids in the following list are used practically. The full list is as follows:

Natural Alkaloids.—1. Quinine, $C_{20}H_{24}N_2O_2$. 2. Quinidine (Conchinine of Hesse), $C_{20}H_{24}N_2O_2$. 3. Cinchonine, $C_{20}H_{24}N_2O$. 4. Cinchonidine, $C_{20}H_{24}N_2O$. 5. Quinamine, $C_{19}H_{24}N_2O_2$. 6. Quinidamine (Conchinamine of Hesse), $C_{19}H_{24}N_2O_2$. 7. Homoquinine or Ultraquinine. 8. Cinchonamine. 9. Paytine, $C_{21}H_{24}N_2OH_2O$. 10. Homocinchonine, $C_{19}H_{22}N_2O$. 11. Homocinchonidine, $C_{19}H_{22}N_2O$. 12. Cusconine, $C_{23}H_{26}N_2O_4 2H_2O$. 13. Cusconidine. 14. Aricine (Cinchovatine of Manzini), $C_{23}H_{26}N_2O_4$. 15. Paricine, $C_{16}H_{18}N_2O$. 16. Paytamine. 17. Dihomocinchonine. 18. Dicinchonine, $C_{40}H_{48}N_4O_2$? 19. Diquinidine (Diconchinine of Hesse), $C_{40}H_{46}N_4O_3$. 20. Javanine. 21. Cincholine.

The Artificial Alkaloids at present known are: 1. Quinicine, $C_{20}H_{24}N_2O_2$. 2. Cinchonicine, $C_{20}H_{24}N_2O$. 3. Quinamicine, $C_{19}H_{24}N_2O_2$. 4. Quinamidine, $C_{19}H_{24}N_2O_2$. 5. Protoquinamicine, $C_{17}H_{20}N_2O_2$. 6. Apoquinamine, $C_{19}H_{22}N_2O$. 7. Homocinchonicine, $C_{19}H_{22}N_2O$. 8. Hydrocinchonine, $C_{20}H_{26}N_2O$. These are chiefly produced by the action of heat upon the natural alkaloids.

One of the principal difficulties in preserving galenical preparations of cinchona arises from the alteration and precipitation which the cinchotannic acid and its compounds undergo upon keeping. Glycerin has proved to be very useful by dissolving and holding these in solution, and hence it is present in nearly every one of the preparations.

Official Preparations.

Infusum Cinchonæ Infusion of Cinchona.	Made by percolating 60 Gm. of cinchona with water containing 1 per cent. of aromatic sulphuric acid to obtain 1000 C.c. (see page 349). Dose, one fluidounce (29 C.c.).
Extractum Cinchonæ Extract of Cinchona.	Made from cinchona with a menstruum of 3 parts of alcohol and 1 part of water (see page 446).
Extractum Cinchonæ Fluidum Fluid Extract of Cinchona.	Made from cinchona with a menstruum of 8 parts of alcohol and 2 parts of glycerin, finishing with a menstruum of 8 parts of alcohol and 2 parts of water (see page 400). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

Official Preparations.—*Continued.*

Tinctura Cinchonæ . . . . Tincture of Cinchona.	Made by percolating 200 Gm. of cinchona with a menstruum of 675 C.c. of alcohol, 250 C.c. of water, and 75 C.c. of glycerin, to obtain 1000 C.c. (see page 365). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).
Tinctura Cinchonæ Composita . Compound Tincture of Cinchona.	Made by percolating 100 Gm. of *red* cinchona, 80 Gm. of bitter orange peel, and 20 Gm. of serpentaria with a menstruum of 850 C.c. of alcohol, 75 C.c. of water, and 75 C.c. of glycerin, to obtain 1000 C.c. (see page 365). Dose, one to four fluidrachms (3.7 to 14.7 C.c.).

QUININA. *U. S.* Quinine.

$C_{20}H_{24}N_2O_2 + 3H_2O = 377.22.$

An alkaloid obtained from the bark of various species of Cinchona (nat. ord. *Rubiaceæ*).

Preparation.—This alkaloid is usually made by adding to the *cooled* acid solution of the sulphate a quantity of ammonia water or solution of soda just sufficient to precipitate the quinine, carefully avoiding an excess.

Quinina. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A white, flaky, amorphous or crystalline powder, permanent in the air. When heated to 57° C. (134.6° F.), it melts, and at 100° C. (212° F.) loses about 9 per cent. (about 2 molecules) of its water of crystallization, the remainder being expelled at 125° C. (257° F.). The anhydrous alkaloid, when pure, melts at 173° C. (343.4° F.). On ignition, the alkaloid is consumed without leaving a residue.	Odorless; very bitter taste; alkaline reaction.	At 15° C. (59° F.), 1670 parts. Boiling, 760 parts.	At 15° C. (59° F.), 6 parts. Boiling, 2 parts.	Soluble in 23 parts of ether, in about 5 parts of chloroform, in about 200 parts of glycerin, and also soluble in carbon disulphide, benzin, benzol, ammonia water, or diluted acids.

Tests.	Impurities.	Tests for Impurities.
The solution of Quinine in diluted sulphuric acid has a vivid blue fluorescence. On treating 10 C.c. of an aqueous, acidulated solution (about 1 in 1500) of Quinine with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or deposit a green precipitate. Quinine should not be reddened by nitric acid (difference from *morphine*).	Readily Carbonizable, Organic Impurities.	Quinine should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	More than small proportions of other Cinchona Alkaloids.	If 2 Gm. of Quinine be mixed, in a small mortar, with 1 Gm. of ammonium sulphate and 10 C.c. of distilled water, the mixture thoroughly dried on a water-bath, the residue (which should be strictly neutral to test-paper) agitated with 20 C.c. of water, then allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, and filtered through a pellet of glass-wool, 5 C.c. of the filtrate transferred to a test-tube, and gently mixed, without shaking, with 7 C.c. of ammonia water (specific gravity 0.960), should produce a clear liquid. If the temperature during the maceration has been 16° C. (60.8° F.), 7.5 C.c. of ammonia water may be added; if 17° C. (62.8° F.), 8 C.c. (In each case a clear liquid indicates the absence of more than small proportions of *other cinchona alkaloids*.)

Uses.—The alkaloid quinine is never used medicinally. Pharmaceutically, it is employed in making elixirs, in iron and quinine citrate, in soluble iron and quinine citrate, and in syrup of iron, quinine, and strychnine phosphates.

QUININÆ SULPHAS. *U. S.* Quinine Sulphate.

$$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 7H_2O = 870.22.$$

Preparation.—The processes which are used for making quinine sulphate, commercially, are regarded as valuable trade secrets, and the manufacturers carefully guard them. The following process, which was formerly official, illustrates one method of making the sulphate of the principal alkaloid from cinchona:

Take of Yellow Cinchona, in coarse powder, 48 oz. troy; Hydrochloric Acid 3½ oz. troy; Lime, in fine powder, 5 oz. troy; Animal Charcoal, in fine powder, Sulphuric Acid, Alcohol, Water, Distilled Water, each, a sufficient quantity. Boil the Cinchona in 13 pints of water mixed with one-third of the Hydrochloric Acid, and strain through muslin. Boil the residue twice successively with the same quantity of Water and Acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add the Lime, previously mixed with 2 pints of Water, stirring constantly, until the quinine is completely precipitated. Wash the precipitate with Distilled Water, and, having pressed, dried, and powdered it, digest it in boiling Alcohol. Pour off the liquid, and repeat the digestion several times, until the Alcohol is no longer rendered bitter. Mix the liquids, and distil off the Alcohol until a brown viscid mass remains. Upon this, transferred to a suitable vessel, pour 4 pints of Distilled Water, and, having heated the mixture to the boiling point, add as much Sulphuric Acid as may be necessary to dissolve the quinine. Then add 1½ oz. troy of Animal Charcoal, boil the liquid for two minutes, filter while hot, and set it aside to crystallize. Should the liquid, before filtration, be entirely neutral, acidulate it very slightly with Sulphuric Acid; should it, on the contrary, change the color of litmus paper to a bright red, add more Animal Charcoal. Separate the crystals from the liquid, dissolve them in boiling Distilled Water slightly acidulated with Sulphuric Acid, add a little Animal Charcoal, filter the solution, and set it aside to crystallize. Lastly, dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stopped bottle. The mother-water may be made to yield an additional quantity of Sulphate of Quinine by precipitating the quinine with Water of Ammonia, and treating the precipitated alkaloid with Distilled Water, Sulphuric Acid, and Animal Charcoal, as before.

The hydrochloric acid forms with the alkaloids soluble hydrochlorates. The lime decomposes the salts by uniting with the acid, and the alkaloids are precipitated with the excess of lime. These are dissolved out with boiling alcohol, the solution evaporated, acidulated with sulphuric acid, decolorized with animal charcoal, and crystallized.

Soda is often used instead of lime to precipitate the alkaloids, because quinine is less soluble in a solution of sodium chloride than in calcium chloride; whilst several manufacturers prefer to use amylic alcohol for

exhausting the lime precipitate of alkaloids. Oil of turpentine and refined petroleum have also been substituted to some extent.

At least three sulphates of quinine have been obtained, of which two are now official. The first of these $(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 7H_2O$, is a "diquinic sulphate," is known and prescribed in Great Britain as *Quininæ Disulphas*, and is the official salt known as quinine sulphate, or *Quininæ Sulphas*, U. S.; the second, formed by dissolving the first in dilute sulphuric acid, has the formula $C_{20}H_{24}N_2O_2H_2SO_4 + 7H_2O$, and is the official quinine bisulphate, or *Quininæ Bisulphas*, U. S.; while the third, which is not official, is the acid sulphate, $C_{20}H_{24}N_2O_2,2H_2SO_4 + 7H_2O$, and may be obtained from a solution of quinine in an excess of dilute sulphuric acid.

Quininæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
White, silky, light and fine, needle-shaped crystals, fragile, and somewhat flexible, making a very light and easily compressible mass, lustreless from superficial efflorescence after standing in the air. The salt is liable to lose water on exposure to warm air, to absorb moisture in damp air, and to become colored by exposure to light. When long exposed to the air, or when kept at 50° to 60° C. (122° to 140° F.) for some hours, it loses most of its water of crystallization (all except 4.1 to 6.2 per cent., or 2 to 3 molecules), the last portion being slowly expelled at 100° to 115° C. (212° to 239° F.). On ignition, the salt burns slowly without leaving a residue.	Odorless; persistent, very bitter taste; neutral reaction.	At 15° C. (59° F.), 740 parts. Boiling, 30 parts.	At 15° C. (59° F.), 65 parts. Boiling, 3 parts.	Soluble in acidulated water, in 40 parts of glycerin, in 680 parts of chloroform, and freely in dilute acids.

Tests.		
On treating 10 C.c. of an aqueous solution (about 1 in 1300) of the salt with 2 drops of bromine water, then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. A cold, saturated aqueous solution of the salt remains unaffected by potassium iodide T.S. (difference from *quinidine sulphate*). Ammonia water added to the aqueous solution of the salt throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid. Quinine Sulphate should not produce a red color with nitric acid (difference from *morphine*).	Limit of Readily Carbonizable, Organic Impurities.	Quinine Sulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	Absence of more than 8 molecules, or 16.18 per cent., of Water.	If 1 Gm. of the salt be dried at a temperature of 115° C. (239° F.) until it ceases to lose weight, the residue should not weigh less than 0.838 Gm.
	See Quinina.	If 2 Gm. of the salt (which must have been previously ascertained to be strictly neutral to litmus paper, or have been rendered so) be dried, as far as possible, at 100° C. (212° F.), the residue then agitated with 20 C.c. of water, and the mixture macerated for half an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see Quinina) the results there given should be obtained.

Uses.—Quinine sulphate is used as an antiperiodic, tonic, and antipyretic. The dose varies from two to twenty grains (0.13 to 1.3 Gm.). It may be given in the form of pills or in solution: in the latter case it is better to suspend it in syrup without using acid, with the addition of a little fluid extract of glycyrrhiza and a drop of ammonia water.

QUININÆ BISULPHAS. *U. S.* Quinine Bisulphate.

$$C_{20}H_{24}N_2O_2H_2SO_4 + 7H_2O = 546.88.$$

Preparation.—This salt is made by adding sulphuric acid to quinine sulphate suspended in water, evaporating the solution, and crystallizing the bisulphate.

Quininæ Bisulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, transparent or whitish, orthorhombic crystals, or small needles, efflorescing on exposure to air. At 100° C. (212° F.) it loses all its water of crystallization (nearly 23 per cent.), and at 135° C. (275° F.) it is converted into quinicine sulphate, which dissolves in diluted sulphuric acid with a yellow color without any blue fluorescence. On ignition, the salt is slowly consumed, leaving no residue.	Odorless; very bitter taste; strongly acid reaction.	At 15° C. (59° F.), 10 parts. Boiling, Very soluble.	At 15° C. (59° F.), 32 parts. Boiling, Very soluble.

Tests.

On treating 10 C.c. of an aqueous solution (about 1 in 1000) of the salt with 2 drops of bromine T.S., and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more diluted solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution of the salt throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. If 1 Gm. of the salt be dried at a temperature of 100° C. (212° F.) until it ceases to lose weight, the remainder, cooled in a desiccator, should weigh not less than 0.77 Gm. (corresponding to 7 molecules, or 23 (22.98) per cent., of water of crystallization).	Limit of Readily Carbonisable Organic Impurities.	Quinine Bisulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	See Quinina.	If 2 Gm. of the salt, dried at 100° C. (212° F.), be agitated with 16 C.c. of water, the mixture made exactly neutral with ammonia water, then brought to the volume of 20 C.c. by the addition of water, and macerated for half an hour at 15° C. (59° F.), upon proceeding further as directed for the corresponding test under Quinine (see Quinina) the results there given should be obtained.

Uses.—The bisulphate has been introduced into medicine in preference to the ordinary sulphate, because of its greater solubility: being seventy times more soluble, it is better adapted for making into pills than the sulphate. It contains 13 per cent. less of the alkaloid than does the sulphate. The difference is to some extent compensated for by the greater solubility, and the dose given is usually that of the sulphate.

QUINIÆ HYDROCHLORAS. *U. S.* Quinine Hydrochlorate.

$$C_{20}H_{24}N_2O_2HCl + 2H_2O = 395.68.$$

Preparation.—Quinine hydrochlorate may be made by double decomposition between quinine sulphate and barium chloride, or by dissolving the alkaloid quinine in diluted hydrochloric acid, evaporating, and crystallizing.

Quininæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
White, silky, light and fine, needle-shaped crystals. The salt is liable to lose water when exposed to warm air. When heated to 120° C. (248° F.) the salt loses its water of crystallization. At about 156° C. (312.8° F.), it begins to melt, but it is not fully melted until the temperature reaches 190° C. (374° F.). On ignition, it is slowly consumed, leaving no residue.	Odorless; very bitter taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 34 parts. Boiling, 1 part.	At 15° C. (59° F.), 3 parts. Boiling, Very soluble.	Soluble in 9 parts of chloroform.

Tests.

The saturated aqueous solution does not show any blue fluorescence, which, however, appears in some degree in more dilute solutions, and markedly so upon addition of dilute sulphuric acid. On treating 10 C.c. of an aqueous solution (about 1 in 1400) of the salt with 2 drops of bromine water, and then with an excess of ammonia, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution throws down a white precipitate soluble in an excess of ammonia water, or in 20 times its weight of ether. Silver nitrate T.S. produces a white precipitate insoluble in nitric acid.	Limit of Readily Carbonizable, Organic Impurities.	Quinine Hydrochlorate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
The salt should not be reddened by nitric acid (difference from *morphine*). If 1 Gm. of the salt be dried at 100° C. (212° F.) until it ceases to lose weight, the residue should not weigh less than 0.9 Gm. (corresponding to 2 molecules, or 9 per cent., of water of crystallization).	Absence of Barium.	The aqueous solution of the salt should not be rendered turbid by dilute sulphuric acid,
	Limit of Sulphate.	And should not be rendered more than slightly turbid by barium chloride T.S.
	See Quinina.	If 3 Gm. of the salt (which must have been previously ascertained to be strictly neutral, or have been rendered so) be mixed, in a small capsule, with 1.5 Gm. of crystallized sodium sulphate and 30 C.c. of water, the mixture thoroughly dried on a water-bath, and the residue agitated with 30 C.c. of water, and allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see Quinina) the results there given should be obtained.

Uses.—This salt is used like the sulphate: it is much more soluble, and is preferable for hypodermic use. The dose is from two to twenty grains (0.13 to 1.3 Gm.).

QUINÌNÆ HYDROBROMAS. *U. S.* Quinine Hydrobromate.

$C_{20}H_{24}N_2O_2HBr + H_2O = 422.06.$

Preparation.—Quinine hydrobromate may be made by decomposing 40 parts of quinine sulphate dissolved in 400 parts of hot alcohol with 11 parts of potassium bromide dissolved in 30 parts of distilled water. Potassium sulphate crystallizes out, and the quinine hydrobromate in solution may be obtained by evaporation and crystallization. In drying the salt, care must be observed not to subject the crystals to heat sufficient to fuse them: a warm dry atmosphere should be relied upon to effect the drying, and all unnecessary exposure to light should be avoided.

Quinine hydrobromate may also be made by double decomposition between quinine sulphate and barium bromide, both in hot alcoholic solution. It is sometimes made by dissolving the alkaloid quinine in hot diluted hydrobromic acid until the latter is no longer acid to litmus paper, evaporating, and crystallizing.

Quininæ Hydrobromas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
White, light, silky needles. The salt is liable to lose water on exposure to warm or dry air. On ignition, the salt burns slowly without leaving a residue. When heated at 100° C. (212° F.), the salt loses its water of crystallization (4.25 per cent.). At 152° C. (305.6° F.) it begins to fuse, and becomes a syrupy liquid at 200° C. (392° F.). Upon ignition, it is slowly consumed, leaving no residue.	Odorless; very bitter taste; neutral or slightly alkaline reaction.	At 15° C. (59° F.), 54 parts. Boiling, Very soluble.	At 15° C. (59° F.), 0.6 part. Boiling, Very soluble.	Soluble in 6 parts of ether and 12 parts of chloroform.

Tests.

Tests.		
On treating 10 C.c. of an aqueous solution (about 1 in 1300) with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. On precipitating a saturated, aqueous solution of the salt with sodium hydrate T.S., filtering, supersaturating the filtrate with acetic acid, adding chloroform and a little chlorine water, and shaking, the chloroform will separate with a yellow color. If 1 Gm. of the salt be dried at 100° C. (212° F.) until it ceases to lose weight, the residue should not weigh less than 0.957 Gm. (corresponding to 1 molecule, or 4.24 per cent., of water of crystallization). Quinine Hydrobromate should not produce a red color with nitric acid (difference from *morphine*).	Limit of Readily Carbonizable, Organic Impurities.	Quinine Hydrobromate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	See Quinina.	If 3 Gm. of the salt (which must have been previously ascertained to be strictly neutral, or have been rendered so) be mixed, in a small capsule, with 1.2 Gm. of crystallized sodium sulphate and 30 C.c. of water, the mixture thoroughly dried on a water-bath, and the residue agitated with 30 C.c. of water, and allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see Quinina) the results there given should be obtained.

Uses.—Quinine hydrobromate is sometimes used hypodermically. Its dose is that of the sulphate, two to twenty grains (0.13 to 1.3 Gm.).

QUININÆ VALERIANAS. *U. S.* Quinine Valerianate.

$$C_{20}H_{24}N_2O_2C_5H_{10}O_2 + H_2O = 443.07.$$

Preparation.—In the former official process quinine was first obtained by decomposing the sulphate, by means of ammonia, and then combining it directly with valerianic acid, to form quinine valerianate, which crystallized from the solution when it cooled, because it is much less soluble in cold than in hot water.

Care must be observed in evaporating the solution and in drying this salt, because of its tendency to decompose. It may also be made by acting on an alcoholic solution of quinine sulphate with sodium valerianate. Quinine valerianate has been known to emit a phosphorescent light in the dark when rubbed in a mortar with a pestle.

Quininæ Valerianas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.
White, or nearly white, pearly, lustrous, triclinic crystals, permanent in the air. When heated to about 90° C. (194° F.), the salt melts, forming a colorless liquid. At 100° C. (212° F.) it loses its water of crystallization, and also begins to lose valerianic acid. On ignition, it burns slowly without leaving a residue.	Slight odor of valerianic acid; bitter taste; neutral or slightly alkaline reaction.	At 15° C. (59° F.), 100 parts. Boiling, 40 parts.	At 15° C. (59° F.), 5 parts. Boiling, 1 part.

Tests.

The aqueous solution, when acidulated with sulphuric acid, has a blue fluorescence, and emits the odor of valerianic acid. On treating 10 C.c. of an aqueous solution (about 1 in 1300) of the salt with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution throws down a white precipitate soluble in an excess of ammonia water, and also in about 20 times its weight of ether.	Limit of Readily Carbonizable, Organic Impurities.	Quinine Valerianate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	Limit of Sulphate.	The aqueous solution of the salt should not be rendered more than slightly turbid by barium chloride T.S.

Uses.—This salt has no especial advantages over the sulphate. The proportion of valerianic acid is too small to have any influence as a nervine. Dose, two to ten grains (0.13 to 0.65 Gm.).

QUINIDINÆ SULPHAS. *U. S.* Quinidine Sulphate.

$$(C_{20}H_{24}N_2O_2)_2H_2SO_4 + 2H_2O = 780.42.$$

The neutral sulphate of an alkaloid obtained from the bark of several species of Cinchona (nat. ord. *Rubiaceæ*).

Preparation.—This salt is obtained from the mother-liquors obtained after the crystallization of quinine.

Quinidinæ Sulphas. U. S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, silky needles, permanent in the air. On ignition, the salt burns slowly without leaving a residue. It parts with its water of crystallisation (4.6 per cent. by weight) at 120° C. (248° F.).	Odorless; very bitter taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 100 parts. Boiling, 7 parts.	At 15° C. (59° F.), 8 parts. Boiling, Very soluble.	Very soluble in acidulated water and in 14 parts of chloroform, but almost insoluble in ether.

Tests.		
The aqueous solution, when acidulated with sulphuric acid, has a decided blue fluorescence. On treating 10 C.c. of an aqueous solution (about 1 in 1600) of the salt with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or deposit a green precipitate. Barium chloride T.S. added to an aqueous solution of the salt throws down a white precipitate insoluble in hydrochloric acid. The salt should not be reddened by nitric acid (difference from *morphine*). A cold, saturated aqueous solution of the salt yields a white precipitate with potassium iodide T.S. (difference from *quinine sulphate*).	Limit of Readily Carbonizable, Organic Impurities.	Quinidine Sulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid.
	Absence of more than Small Proportions of Other Cinchona Alkaloids.	If a little ammonia water is added to 3 C.c. of an aqueous solution of the salt saturated at 15° C. (59° F.), a white precipitate (*quinidine*) is produced, which requires more than 30 C.c. of ammonia water, or more than 30 times its weight of ether, to dissolve it.

Quinidine differs from quinine in being dextrogyre (quinine is lævogyre), and in being almost insoluble in ether.

Uses.—This salt is equally efficient with quinine sulphate in the treatment of malaria and as an antiperiodic and antipyretic. Dose, two to twenty grains (0.13 to 1.3 Gm.).

CINCHONINA. *U. S.* Cinchonine.

$$C_{19}H_{22}N_2O = 293.41.$$

An alkaloid obtained from the bark of various species of Cinchona.

Preparation.—Cinchonine may be obtained from the mother-waters of quinine sulphate by diluting them with water, precipitating with ammonia, collecting the precipitate on a filter, washing and drying it, and then dissolving it in boiling alcohol, which deposits the cinchonine in a crystalline form upon cooling. It may be still further purified by a second solution and crystallization.

Cinchonina. U. S.	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, lustrous prisms or needles, permanent in the air. At 240° C. (464° F.) the crystals fuse together, and at 258° C. (496.4° F.) they melt, forming a brown liquid. When ignited, they are consumed without leaving a residue.	Odorless; at first nearly tasteless, but developing a bitter after-taste; alkaline reaction.	At 15° C. (59° F.), Cold, 3760 parts. Boiling, 3500 parts.	Cold, 116 parts. Boiling, 26.5 parts.	In 526 parts of ether; 163 parts of chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
On adding to a neutral or not more than faintly acid solution of Cinchonine, or any of its salts, enough potassium ferrocyanide T.S. to redissolve the precipitate first formed, and afterwards an acid, a golden-yellow precipitate will be formed, which, when redissolved by gently warming the liquid, will separate, on cooling, in minute scales or needles.	More than traces of Quinine or Quinidine.	A solution of the alkaloid (1 in 1000) in diluted sulphuric acid should not exhibit more than a faint blue fluorescence.
On adding an excess of ammonia water to a solution of Cinchonine in a dilute acid, the alkaloid will be precipitated.	Readily Carbonizable, Organic Impurities.	The salt should not be colored, or but very slightly colored yellow, by the addition of concentrated sulphuric acid.

Uses.—Cinchonine is not used medicinally, because of its insolubility in water. It is used pharmaceutically to some extent in elixirs, etc., as it is more soluble in alcohol.

CINCHONINÆ SULPHAS. *U. S.* Cinchonine Sulphate.

$(C_{19}H_{22}N_2O)_2H_2SO_4 + 2H_2O = 720.56.$

Preparation.—In consequence of its greater solubility, cinchonine sulphate remains behind in the mother-waters, when quinine sulphate crystallizes, in the process for preparing the latter. Cinchonine is obtained from quinine mother-liquors by precipitation with solution of soda. The precipitated cinchonine is washed, converted into a sulphate by the addition of sulphuric acid, decolorized, and crystallized.

Cinchoninæ Sulphas. U. S.	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Hard, white, lustrous, prismatic crystals, permanent in the air. At 100° C. (212° F.) the salt loses its water of crystallization, and at about 215° C. (419° F.) it melts, forming a brown liquid. On ignition, the salt is dissipated without leaving a residue. The aqueous solution of the salt yields a curdy precipitate with mercuric potassium iodide T.S.	Odorless; very bitter taste; neutral reaction.	At 15° C. (59° F.), 66 parts. Boiling, 13.59 parts.	Cold, 10 parts. Boiling, 3.25 parts.	In 78 parts of chloroform, almost insoluble in ether.

Tests.

The salt yields with ammonia water a white precipitate (Cinchonine) which is very sparingly soluble in an excess of ammonia (difference from *quinine*). With barium chloride it yields a white precipitate insoluble in hydrochloric acid.	Limit of Quinine or Quinidine.	A solution of the salt (1 in 1000) acidulated with sulphuric acid should not show more than a faint blue fluorescence.
If 1 part of the salt, reduced to powder, be macerated, with frequent agitation, with 80 times its weight of chloroform at 15° C. (59° F.), it should wholly, or almost wholly, dissolve (any more than traces of *quinine sulphate* or of *cinchonidine sulphate* remaining undissolved).	Undue Amount of Water.	If 1 Gm. be dried at 100° C. (212° F.) until it ceases to lose weight, the residue, cooled in a desiccator, should weigh not less than 0.95 Gm.
	Readily Carbonizable, Organic Impurities.	The salt should not impart more than a faintly yellowish tinge to concentrated sulphuric acid.

Uses.—Cinchonine sulphate is used as a tonic and febrifuge. Its cheapness has led to its extensive employment as a substitute for quinine. The dose is larger, however, as an antiperiodic: fifteen to forty grains (0.9 to 2.6 Gm.) have been given.

CINCHONIDINÆ SULPHAS. Cinchonidine Sulphate.

$$(C_{19}H_{22}N_2O)_2H_2SO_4 + 3H_2O = 738.52.$$

The neutral sulphate of an alkaloid obtained from the bark of various species of Cinchona.

Preparation.—This alkaloidal salt is also obtained from the quinine mother-liquors by fractional crystallization. The Indian barks contain a larger proportion of it than the South American varieties.

Cinchonidinæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
White, silky, acicular crystals, slightly efflorescent on exposure to air. At 100° C. (212° F.) the salt loses its water of crystallization.	Odorless; very bitter taste; neutral or faintly alkaline reaction.	At 15° C. (59° F.), 70 parts. Boiling, 1.42 parts.	Cold, 66 parts. Boiling, 3 parts.	Freely soluble in acidulated water, and in 1316 parts of chloroform (the undissolved portions becoming gelatinous); very sparingly soluble in ether or benzol. The presence of sulphates of other cinchona alkaloids increases its solubility in ether and chloroform.

Tests for Identity.	Impurities.	Tests for Impurities.
At 215° C. (419° F.) the salt melts, and on ignition it is dissipated without leaving a residue. The aqueous solution of the salt yields, on addition of ammonia water, a white precipitate (Cinchonidine) which requires a large excess of ammonia to dissolve it, and which is soluble in about 75 parts of ether. With barium chloride T.S. a white precipitate, insoluble in hydrochloric acid, is formed. If concentrated sulphuric acid be added to a small quantity of the salt, not more than a faintly yellowish color should be developed (limit of *readily carbonizable, organic impurities*). Upon adding to this liquid a crystal of potassium dichromate, a yellowish-green color is produced, which gradually changes to grass-green.	More than traces of Quinine or Quinidine Sulphate.	A solution of the salt (about 1 in 1000) in diluted sulphuric acid should not show more than a slight blue fluorescence.
	Foreign Organic Matters.	The salt should not be colored by the addition of sulphuric acid.
	Undue Amount of Water.	If 1 Gm. be dried at 100° C. (212° F.) until it ceases to lose weight, the residue, cooled in a desiccator, should weigh not less than 0.920 Gm.
	More than small proportions of Cinchonine Sulphate, or more than small proportions of Quinidine Sulphate.	If 0.5 Gm. of the salt be macerated, with frequent agitation, at the ordinary temperature, with 20 C.c. of cold distilled water, 0.5 Gm. of potassium and sodium tartrate added, the mixture macerated, with frequent agitation, for one hour at 15° C. (59° F.), then filtered, and a drop of ammonia water added to the filtrate, not more than a slight turbidity should appear.

Uses.—This salt closely resembles quinine sulphate in its medicinal effects, and may be used for the same purposes in somewhat larger doses.

NUX VOMICA. *U. S.* Nux Vomica.

The seed of *Strychnos Nux-vomica* Linné (nat. ord. *Loganiaceæ*).

Nux vomica contains *strychnine, brucine,* $C_{23}H_{26}N_2O_4$, probably *loganin, igasuric acid,* protein compounds, gum, fixed oil, sugar, etc. Strychnine is official, and will be considered separately. Brucine is readily soluble in alcohol and in chloroform; it is colored bright red by nitric acid, and its solution acquires a rose-red coloration with chlorine water. The presence of igasurine is now considered doubtful. The fixed oil is soluble in alcohol, and the alkaloids are soluble in the oil: in making the extract the oil should be separated and shaken with diluted alcohol to dissolve the alkaloids. This solution should be evaporated and mixed with the extract. Nux vomica is poisonous in large doses; in doses of three grains (0.19 Gm.) it is tonic.

Official Preparations.

Extractum Nucis Vomicæ . . . . . Extract of Nux Vomica.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 452). Dose, one-half to two grains (0.03 to 0.13 Gm.).
Extractum Nucis Vomicæ Fluidum . Fluid Extract of Nux Vomica.	Made with a menstruum of 3 parts of alcohol and 1 part of water, with 5 per cent. of acetic acid (see page 415). Dose, one to three minims (0.06 to 0.18 C.c.).
Tinctura Nucis Vomicæ . . . . . . Tincture of Nux Vomica.	Made by dissolving 20 Gm. of extract of nux vomica in a mixture of 3 parts of alcohol and 1 part of water, to make 1000 C.c. (see page 373). Dose, twenty minims (1.2 C.c.).

STRYCHNINA. *U. S.* Strychnine.

$$C_{21}H_{22}N_2O_2 = 333.31.$$

An alkaloid obtained from Nux Vomica, and also obtainable from other plants of the natural order *Loganiaceæ*.

Preparation.—Strychnine may be made by the process formerly official, as follows:

Take of Nux Vomica, rasped, 48 oz. troy; Lime, in fine powder, 6 oz. troy; Hydrochloric Acid, 3½ oz. troy; Alcohol, Diluted Alcohol, Diluted Sulphuric Acid, Water of Ammonia, Purified Animal Charcoal, Water, each, a sufficient quantity. Macerate the Nux Vomica for twenty-four hours in 16 pints of water, acidulated with one-third of the Hydrochloric Acid; then boil for two hours, and strain with expression through a strong muslin bag. Boil the residue twice successively in the same quantity of acidulated Water, each time straining as before. Mix the decoctions and evaporate to the consistence of thin syrup; then add the Lime previously mixed with a pint of Water, and boil for ten minutes, frequently stirring. Pour the whole into a double muslin bag, and, having thoroughly washed the precipitate, press, dry, and powder it. Treat the powder repeatedly with Diluted Alcohol, in order to remove the brucine, until the washings are but faintly reddened

by nitric acid. Then boil it repeatedly with Alcohol until deprived of its bitterness, mix the several tinctures, and distil off the Alcohol by means of a water-bath. Having washed the residue, mix it with a pint of Water, and, applying a gentle heat, drop in enough Diluted Sulphuric Acid to neutralize and dissolve the alkaloid. Then add Purified Animal Charcoal, and, having boiled the mixture for a few minutes, filter, evaporate, and set aside to crystallize. Dissolve the crystals in Water, and add sufficient Water of Ammonia to precipitate the Strychnine. Lastly, dry this on bibulous paper, and keep it in a well-stopped bottle.

In this process strychnine hydrochlorate is formed: this is decomposed by lime, and the strychnine is dissolved out of the excess of lime with boiling alcohol (the brucine having been previously removed by treatment with diluted alcohol), the alcoholic solution is evaporated, and sulphuric acid added to dissolve the alkaloid; the solution is decolorized and evaporated to crystallize. The crystals of strychnine sulphate are dissolved and strychnine precipitated by adding ammonia water.

Strychnina. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, transparent, octohedral or prismatic crystals, or a white, crystalline powder, permanent in the air. When heated to 268° C. (514.4° F.), Strychnine melts. Upon ignition, it is consumed, leaving no residue.	Odorless; intensely bitter taste, which is still perceptible in a highly dilute (1 in 700,000) solution; alkaline reaction.	At 15° C. (59° F.), 6700 parts. Boiling, 2500 parts.	At 15° C. (59° F.), 110 parts. Boiling, 12 parts.	Soluble in 7 parts of chloroform, but almost insoluble in ether.

Test for Identity.	Impurity.	Test for Impurity.
If a minute quantity of Strychnine be dissolved in about 0.5 C.c. of concentrated sulphuric acid, on a white porcelain surface, and a small crystal of potassium dichromate slowly drawn across the liquid with a glass rod, there will be produced at first, momentarily, a blue color, which quickly changes to purplish-blue, then gradually to violet, purplish-red, and cherry-red, and finally to orange or yellow.	Brucine.	On dissolving 0.02 Gm. of Strychnine in 2 C.c. of nitric acid (specific gravity 1.300), in a small test-tube, the acid should not turn more than faintly yellow.

Uses.—Strychnine is tonic in doses of one-sixtieth of a grain (0.001 Gm.). It may sometimes be given in doses of one-twentieth of a grain (0.003 Gm.).

STRYCHNINÆ SULPHAS. *U. S.* Strychnine Sulphate.

$$(C_{21}H_{22}N_2O_2)_2H_2SO_4 + 5H_2O = 854.24.$$

Preparation.—This salt is prepared during the process for making strychnine. (See preceding article.)

Strychninæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvent.
Colorless or white, prismatic crystals, efflorescent in dry air. When heated to 100° C. (212° F.), the salt slowly loses its water of crystallization (10.51 per cent.); more rapidly when heated to 110° C. (230° F.). When quickly heated to 200° C. (392° F.), the salt fuses. Upon ignition, it is consumed, leaving no residue.	Odorless; intensely bitter taste, which is still perceptible in a highly dilute (1 in 700,000) solution; neutral reaction.	At 15° C. (59° F.), 50 parts. Boiling, 2 parts.	At 15° C. (59° F.), 109 parts. Boiling, 8.5 parts.	Almost insoluble in ether.

Tests for Identity.	Impurity.	Test for Impurity.
On adding potassium or sodium hydrate T.S. to an aqueous solution of the salt, a white precipitate is thrown down, which is insoluble in an excess of the alkali, and which should respond to the reactions and tests of strychnine (see Strychnina). Barium chloride T.S. added to the aqueous solution throws down a white precipitate insoluble in hydrochloric acid.	Brucine.	On dissolving 0.05 Gm. of Strychnine Sulphate in 2 C.c. of nitric acid (specific gravity 1.300), in a small test-tube, the acid should not turn more than faintly yellow.

Uses.—Strychnine sulphate is more useful, medicinally, than strychnine only because it is much more soluble. The dose is one-twentieth of a grain (0.003 Gm.).

GELSEMIUM. *U. S.* Gelsemium. [Yellow Jasmine.]

The rhizome and roots of *Gelsemium sempervirens* (Linné) Persoon (nat. ord. *Loganiaceæ*).

Gelsemium contains *gelsemine*, $C_{11}H_{12}NO_2$, gelseminic acid, volatile oil, starch, resin, fat, coloring-matter, etc. Alcohol is the best solvent for its active principles. It is used as an antispasmodic and sedative. Dose, three grains (0.19 Gm.).

Official Preparations.

Extractum Gelsemii Fluidum . Fluid Extract of Gelsemium.	Made with alcohol (see page 407). Dose, two to three minims (0.12 to 0.18 C.c.).
Tinctura Gelsemii . . . . . . Tincture of Gelsemium.	Made by percolating 150 Gm. of gelsemium with a menstruum of 65 parts of alcohol and 35 parts of water until 1000 C.c. are obtained (see page 368). Dose, ten to twenty minims (0.6 to 1.2 C.c.).

PHYSOSTIGMA. *U. S.* Physostigma. [Calabar Bean.]

The seed of *Physostigma venenosum* Balfour (nat. ord. *Leguminosæ*).

Physostigma contains *physostigmine*, or *eserine*, $C_{15}H_{21}N_3O_2$, as it is more frequently called. This alkaloid is amorphous and without taste, soluble in water, but more soluble in alcohol, ether, chloroform, carbon disulphide, and benzol. It also contains *calabarine*, an alkaloid derived from eserine, with a neutral principle, *physosterin*, starch, protein compounds, mucilage, etc.

Physostigma is sedative, and acts as a powerful poison, contracting the pupil of the eye. Dose, one to three grains (0.06 to 0.19 Gm.).

Official Preparations.

Extractum Physostigmatis . Extract of Physostigma.	Made with alcohol (see page 455). Dose, one-eighth of a grain (0.008 Gm.).
Tinctura Physostigmatis . . Tincture of Physostigma.	Made by percolating 150 Gm. of physostigma with sufficient alcohol to make 1000 C.c. (see page 375). Dose, twenty minims (1.2 C.c.).

PHYSOSTIGMINÆ SALICYLAS. *U. S.* Physostigmine Salicylate.

$C_{15}H_{21}N_3O_2C_7H_6O_3$; 412.17.

[ESERINE SALICYLATE.]

The salicylate of an alkaloid obtained from Physostigma.

Preparation.—This salt may be made by adding 2 parts of physostigmine to a solution of 1 part of salicylic acid in 35 parts of boiling distilled water, and allowing the salt to crystallize on cooling.

Physostigminæ Salicylas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless or faintly yellowish, shining, acicular, or short, columnar crystals, gradually turning reddish when long exposed to air and light. When heated on platinum foil, the salt is completely dissipated.	Odorless; bitter taste; faintly acid reaction.	At 15° C. (59° F.), 150 parts. Boiling, 30 parts.	At 15° C. (59° F.), 12 parts. Boiling, Very soluble.

Tests for Identity.

When heated to about 179° C. (354.2° F.), the salt melts. Upon ignition, it is consumed, leaving no residue. On adding a small portion of the salt to colorless, concentrated sulphuric acid, the latter assumes a tint not deeper than yellow.

If a minute portion of the salt be added to a few C.c. of ammonia water, in a small capsule, the liquid will acquire a yellowish-red color. On evaporating the liquid, on a water-bath, a blue residue will be left, which yields, with alcohol, a blue solution becoming violet-red upon supersaturation with acetic acid, and exhibiting a strong, reddish fluorescence.

The aqueous solution of the salt, when mixed with ferric chloride T.S., assumes a deep violet color.

Uses.—The salts of physostigmine, or eserine, are used to contract the pupil of the eye. The advantage possessed by the salicylate is that it is more permanent and less liable to deliquesce. The dose for internal administration should not be more than one-twentieth of a grain (0.003 Gm.).

PHYSOSTIGMINÆ SULPHAS. *U. S.* Physostigmine Sulphate.

$(C_{15}H_{21}N_3O_2)_2H_2SO_4$; 646.82.

[ESERINE SULPHATE.]

The sulphate of an alkaloid obtained from Physostigma.

This salt has the disadvantage of being very deliquescent: the salicylate is to be preferred.

Physostigminæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A white or yellowish-white, micro-crystalline powder, very deliquescent when exposed to moist air, and gradually turning reddish by exposure to air and light. At 105° C. (221° F.), the salt melts, and upon ignition it is consumed, leaving no residue.	Odorless; having a bitter taste and a neutral reaction.	Very soluble.	Very soluble.

Tests.
On adding a small portion of the salt to colorless, concentrated sulphuric acid, the latter should not assume a tint deeper than yellow.
If a minute portion of the salt be added to a few C.c. of ammonia water in a small capsule, the liquid will acquire a yellowish-red color. On evaporating this liquid on a water-bath, a blue or bluish-gray residue will be left, which yields, with alcohol, a blue solution becoming violet-red upon supersaturation with acetic acid, and exhibiting a strong reddish fluorescence.
The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid.

Uses.—The dose of physostigmine sulphate is one-twentieth of a grain (0.003 Gm.).

BELLADONNÆ FOLIA. *U. S.* Belladonna Leaves.

The leaves of *Atropa Belladonna* Linné (nat. ord. *Solanaceæ*).

BELLADONNÆ RADIX. *U. S.* Belladonna Root.

The root of *Atropa Belladonna* Linné (nat. ord. *Solanaceæ*).

Belladonna owes its activity to *atropine*, $C_{17}H_{23}NO_3$, and a small quantity of *hyoscyamine:* belladonine is also present. Atropine and hyoscyamine and some of their salts are official. Belladonna is narcotic and poisonous: it dilates the pupil of the eye. Dose, one to two grains (0.06 to 0.12 Gm.).

Official Preparations.

Leaves.

Extractum Belladonnæ Foliorum Alcoholicum . Made with belladonna leaves and a menstruum of 2 parts of alcohol and 1 part of water (see page 445). Dose, one-fourth grain (0.016 Gm.).
Alcoholic Extract of Belladonna Leaves.

Emplastrum Belladonnæ . . . . Made by incorporating 2 parts of alcoholic extract of belladonna leaves with 4 parts each of resin plaster and soap plaster. (See Emplastra.)
Belladonna Plaster.

Tinctura Belladonnæ Foliorum . . . . Made by percolating 150 Gm. of belladonna leaves with sufficient diluted alcohol to make 1000 C.c. (see page 361). Dose, ten to twenty minims (0.6 to 1.2 C.c.).
Tincture of Belladonna Leaves.

Unguentum Belladonnæ . . . . Made by rubbing 10 Gm. of alcoholic extract of belladonna with 5 Gm. of diluted alcohol, and incorporating 85 Gm. of benzoinated lard. (See Unguenta.)
Belladonna Ointment.

Root.

Extractum Belladonnæ Radicis Fluidum . . . Made from belladonna root with a menstruum of 4 parts of alcohol and 1 part of water (see page 397). Dose, one to two minims (0.06 to 0.12 C.c.).
Fluid Extract of Belladonna Root.

Linimentum Belladonnæ . . . . Made by dissolving 5 Gm. of camphor in 95 C.c. of fluid extract of belladonna (see page 340).
Belladonna Liniment.

ATROPINA. *U.S.* Atropine.

$C_{17}H_{23}NO_3$; 288.38.

An alkaloid obtained from Belladonna. As it occurs in commerce, it is always accompanied by a small proportion of hyoscyamine extracted along with it, from which it cannot be readily separated.

Preparation.—This alkaloid may be prepared by adding sulphuric acid to a concentrated alcoholic tincture of the root to convert the atropine into the sulphate, distilling off the alcohol, adding water to the residuary liquid, filtering to separate oil and resin, and treating the filtrate with potassium hydrate and chloroform. By evaporating the latter, atropine is obtained.

Atropina. *U.S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, acicular crystals, or a more or less amorphous, white powder, and gradually assuming a yellowish tint on exposure to air. Its saturated aqueous solution acquires a pink color upon the addition of a drop of phenolphtalein T.S. At about 108° C. (226.4° F.) it melts, forming a colorless liquid; at about 140° C. (284° F.) it begins to give off white, acrid fumes, and when ignited it is consumed without leaving a residue. Atropine and its salts are decomposed by prolonged contact with sodium or potassium hydrate, and, if heated with either of them, evolve ammonia.	Odorless; bitter and acrid taste; markedly alkaline reaction.	At 15° C. (59° F.), Cold, 130 parts.	3 parts.	Soluble in 4 parts of chloroform, 16 parts of ether, and about 50 parts of glycerin.

TESTS FOR IDENTITY, QUALITATIVE TESTS, ETC.

With sulphuric acid Atropine yields a colorless solution, which is not colored by nitric acid (absence of and difference from *morphine*). If a small quantity of Atropine, or one of its salts, be heated with a few C.c. of concentrated sulphuric acid, a peculiar odor, recalling that of a mixture of rose, orange flower, and melilot, will become noticeable. On now gradually adding minute fragments of potassium dichromate, the odor will change to that of oil of bitter almond, the rose odor disappearing as more dichromate is added.

On dissolving a small quantity (about 0.1 Gm.) of Atropine in 2 C.c. of alcohol, and adding an equal volume of mercuric chloride T.S., a yellow precipitate, which soon turns red, is produced.

On adding concentrated sulphuric acid to Atropine, no color should be produced (absence of *readily carbonizable, organic impurities*). The aqueous solution of Atropine, or of any of its salts, is not precipitated by platinic chloride T.S. (difference from *most other alkaloids*). With gold chloride it yields a precipitate which, when recrystallized from boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute crystals, forming a yellow, lustreless powder on drying (difference from *hyoscyamine*).

Uses.—Atropine is chiefly used to dilate the pupil of the eye: the sulphate, however, is preferred, on account of its solubility. It has the properties of belladonna when given internally, and is narcotic. Dose, one one-hundred-and-twentieth to one-sixtieth of a grain (0.0005 to 0.001 Gm.).

ATROPINÆ SULPHAS. *U.S.* Atropine Sulphate.

$(C_{17}H_{23}NO_3)_2H_2SO_4$; 674.58.

Preparation.—Atropine sulphate may be prepared by suspending 120 grains of atropine in 4 fl. dr. of distilled water and adding diluted

sulphuric acid until the alkaloid is dissolved and the solution is neutral. The latter is then evaporated to dryness at a temperature not exceeding 37.7° C. (100° F.).

Atropinæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A white, indistinctly crystalline powder, permanent in the air. At 187° C. (309° F.) the salt melts, forming a brownish-yellow liquid. When ignited, it chars, emits acrid vapors, and is completely consumed.	Odorless; very bitter, nauseating taste; neutral reaction.	At 15° C. (59° F.), 0.4 part.	Cold, 6.2 parts.	2270 parts of ether; 694 parts of chloroform.

Tests for Identity.
On adding sodium carbonate T.S. to a concentrated aqueous solution of the salt, a white precipitate is obtained which answers to the reactions of Atropine. (See Atropina.) An aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid.

Uses.—Atropine sulphate is preferred to the alkaloid for use as a mydriatic: an aqueous solution is generally employed for this purpose. The internal dose is from one one-hundred-and-twentieth to one-sixtieth of a grain (0.0005 to 0.001 Gm.).

HYOSCYAMUS. *U. S.* Hyoscyamus. [Henbane.]

The leaves and flowering tops of *Hyoscyamus niger* Linné (nat. ord. *Solanaceæ*), collected from plants of the second year's growth.

Hyoscyamus contains *hyoscyamine*, $C_{17}H_{23}NO_3$, *hyoscine*, $C_{17}H_{23}NO_3$, *hyoscypicrin*, $C_{27}H_{52}O_{14}$, chlorophyll, mucilage, extractive, etc. Hyoscyamus is narcotic, hypnotic, and slightly laxative. Dose, five grains (0.3 Gm.).

Official Preparations.

Extractum Hyoscyami . . . . . . Extract of Hyoscyamus.	Made with 2 parts of alcohol and 1 part of water (see page 450). Dose, one to two grains (0.06 to 0.12 Gm.).
Extractum Hyoscyami Fluidum . Fluid Extract of Hyoscyamus.	Made with 2 parts of alcohol and 1 part of water (see page 410). Dose, five minims (0.3 C.c.).
Tinctura Hyoscyami . . . . Tincture of Hyoscyamus.	Made by percolating 150 Gm. of hyoscyamus with sufficient diluted alcohol to make 1000 C.c. (see page 369). Dose, one fluidrachm (3.7 C.c.).

HYOSCINÆ HYDROBROMAS. *U. S.* Hyoscine Hydrobromate.

$C_{17}H_{21}NO_4HBr + 3H_2O$; 486.98.

The hydrobromate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered vials.

Hyoscine is prepared by evaporating the mother-waters obtained after the crystallization of hyoscyamine.

Hyoscinæ Hydrobromas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, transparent, rhombic crystals, permanent in the air. When heated to 100° C. (212° F.) the salt loses its water of crystallization, and fuses to a thick, syrupy mass, which becomes quite fluid at 160° C. (320° F.).	Odorless; acrid, slightly bitter taste; neutral reaction.	At 15° C. (59° F.), 1.9 parts.	Cold, 13 parts.	Very slightly soluble in ether or chloroform.

Tests for Identity.

When ignited, it is consumed, leaving no residue. Addition of ammonia water to the aqueous solution of the salt (1 in 60) produces no change, but sodium or potassium hydrate T.S. causes a white turbidity. Addition of silver nitrate T.S. to the aqueous solution produces a yellowish-white precipitate, which is insoluble in nitric acid, but, when filtered off and washed, is soluble in ammonia water diluted with its own volume of water.

If 5 drops of fuming nitric acid be added to 0.01 Gm. of the salt, in a small porcelain capsule, and the mixture be evaporated to dryness on a water-bath, a scarcely tinted residue will be left, which, when treated, after cooling, with a few drops of an alcoholic solution of potassium hydrate, will assume a violet color.

Uses.—The salts of hyoscine are very powerful, and impure amorphous hyoscyamine often contains hyoscine. Hyoscine hydrobromate is a soporific in small doses, one one-hundred-and-twentieth of a grain (0.0005 Gm.), but powerfully narcotic in larger doses.

HYOSCYAMINÆ HYDROBROMAS. *U. S.* Hyoscyamine Hydrobromate.

$$C_{17}H_{23}NO_3HBr = 369.14.$$

The hydrobromate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered bottles.

This salt was introduced into the U. S. P. 1890. It is somewhat more stable than the sulphate.

Hyoscyaminæ Hydrobromas. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
A yellowish-white, amorphous, resin-like mass, or prismatic crystals, deliquescent on exposure to air. At 78° C. (172.4° F.) the salt melts, forming a nearly colorless liquid. When ignited, it is consumed, leaving no residue.	Tobacco-like odor, particularly when damp; acrid, nauseous, and bitter taste; neutral reaction.	At 15° C. (59° F.), 0.3 part.	Cold, 2 parts.	3000 parts of ether, or 250 parts of chloroform.

Tests for Identity.

An aqueous solution of the salt is not precipitated by platinic chloride T.S. (difference from *most other alkaloids*). With gold chloride T.S. it yields a precipitate which, when recrystallized from a small quantity of boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute, lustrous, golden-yellow scales (difference from *atropine*).

The aqueous solution of the salt yields, with silver nitrate T.S., a yellowish-white precipitate, which is insoluble in nitric acid, but, when filtered off and washed, is soluble in ammonia water diluted with its own volume of water.

Uses.—This salt is used as a narcotic and sedative. The dose is one-sixtieth of a grain (0.001 Gm.).

HYOSCYAMINÆ SULPHAS. *U. S.* Hyoscyamine Sulphate.

$(C_{17}H_{23}NO_3)_2H_2SO_4$; 674.58.

The neutral sulphate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered vials.

Preparation.—The acidulated tincture of the seeds, deprived of their fixed oil, is evaporated and almost neutralized with soda, and then precipitated with tannin. The moist precipitate, mixed with lime, is exhausted with alcohol, and the solution acidulated, concentrated, and agitated with ether to remove coloring-matter and oil. The hyoscyamine sulphate is decolorized and recrystallized.

Hyoscyaminæ Sulphas. *U. S.*	Tests for Identity.
White, indistinct crystals, or a white powder, deliquescent on exposure to damp air, odorless, having a bitter and acrid taste and a neutral reaction, soluble in 0.5 part of water and in 2.5 parts of alcohol, very slightly soluble in ether or chloroform. An aqueous solution of the salt is not precipitated by platinic chloride T.S. (difference from *most other alkaloids*).	With gold chloride T.S. it yields a precipitate which, when recrystallized from boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute, lustrous, golden-yellow scales (difference from *atropine*). The aqueous solution yields with barium chloride a white precipitate insoluble in hydrochloric acid.

Uses.—This salt of hyoscyamine is used as a narcotic and sedative, in doses of one-sixtieth of a grain (0.001 Gm.): it is largely used by alienists in controlling maniacal excitement. It is occasionally used as a mydriatic.

STRAMONII FOLIA. *U. S.* Stramonium Leaves.

The leaves of *Datura Stramonium* Linné (nat. ord. *Solanaceæ*).

STRAMONII SEMEN. *U. S.* Stramonium Seed.

The seed of *Datura Stramonium* Linné (nat. ord. *Solanaceæ*).

Stramonium contains *daturine*, which has been proved to be a mixture of hyoscyamine and atropine: the leaves contain albumen, mucilage, and potassium nitrate. In the seeds there is found about 25 per cent. of fixed oil, with resins, mucilage, etc. Stramonium is narcotic and poisonous. Dose, two to three grains (0.13 to 0.19 Gm.).

Official Preparations.

Extractum Stramonii Seminis . . . . . Extract of Stramonium Seed.	Made with stramonium *seed* and a menstruum of diluted alcohol (see page 456). Dose, half a grain (0.03 Gm.).
Extractum Stramonii Seminis Fluidum . Fluid Extract of Stramonium Seed.	Made with stramonium *seed* and a menstruum of 3 parts of alcohol and 1 part of water (see page 425). Dose, one to two minims (0.06 to 0.12 C.c.).
Tinctura Stramonii Seminis . . . . . . Tincture of Stramonium Seed.	Made by percolating 150 Gm. of stramonium *seed* with sufficient diluted alcohol to make 1000 C.c. (see page 378). Dose, twenty minims (1.2 C.c.).
Unguentum Stramonii . . . . Stramonium Ointment.	Made by rubbing 10 Gm. of extract of stramonium *seed* with 5 Gm. of water, and incorporating with 85 Gm. of benzoinated lard. (See Unguenta.)

DULCAMARA. *U. S.* Dulcamara. [BITTERSWEET.]

The young branches of *Solanum Dulcamara* Linné (nat. ord. *Solanaceæ*).

Dulcamara contains *solanine*, an alkaloid, and *dulcamarin*, $C_{22}H_{34}O_{10}$, a glucoside: the latter is the bitter and sweet principle. The other constituents are gum, wax, fat, resin, etc.

Official Preparation.

Extractum Dulcamaræ Fluidum . Fluid Extract of Dulcamara.	Made with diluted alcohol (see page 404). Dose, thirty to sixty minims (1.8 to 3.7 C.c.).

PILOCARPUS. *U. S.* Pilocarpus. [JABORANDI.]

The leaflets of *Pilocarpus Selloanus* Engler (Rio Janeiro Jaborandi), and of *Pilocarpus Jaborandi* Holmes (Pernambuco Jaborandi), (nat. ord. *Rutaceæ*).

Pilocarpus contains *pilocarpine*, $C_{11}H_{16}N_2O_2$, and a volatile oil consisting principally of *dipentene*, $C_{10}H_{16}$, a terpene. The leaves are coriaceous and difficult to powder. It is diaphoretic and sialagogue. Dose, twenty grains (1.3 Gm.).

Official Preparation.

Extractum Pilocarpi Fluidum . Fluid Extract of Pilocarpus.	Made with diluted alcohol (see page 416). Dose, fifteen to thirty minims (0.9 to 1.8 C.c.).

PILOCARPINÆ HYDROCHLORAS. *U. S.* Pilocarpine Hydrochlorate.

$C_{11}H_{16}N_2O_2.HCl$; 248.98.

The hydrochlorate of an alkaloid obtained from Pilocarpus.

Preparation.—Pilocarpine is added to diluted hydrochloric acid until it is neutralized, and the solution is then concentrated and crystallized.

Pilocarpinæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Minute, white crystals, deliquescent on exposure to damp air. When heated to 197° C. (386.6° F.) the salt melts, and upon ignition it is consumed, leaving no residue.	Odorless; faintly bitter taste; neutral reaction.	Very soluble.	Very soluble.	Almost insoluble in ether or chloroform.

Tests for Identity.
Concentrated sulphuric acid dissolves the salt to a colorless liquid, with evolution of hydrochloric acid vapor. If a small fragment of potassium dichromate be added to a few drops of this solution, on a white porcelain surface, the dichromate will gradually dissolve with a vivid dark green color.
Fuming nitric acid dissolves the salt with a faintly greenish tint. The aqueous solution (1 in 100) of the salt is precipitated by iodine T.S., bromine water, mercuric chloride T.S., and most other reagents for alkaloids.
If the aqueous solution be slightly acidulated, the subsequent addition of ammonia water will produce no precipitate. Sodium hydrate T.S. produces a precipitate only in a concentrated solution of the salt.
The aqueous solution yields with silver nitrate T.S. a white precipitate insoluble in nitric acid.

Uses.—Pilocarpine hydrochlorate is a diaphoretic and sialagogue, and is often used hypodermically. Dose, one-eighth to one-fourth of a grain (0.008 to 0.016 Gm.).

COLCHICI RADIX. *U. S.* Colchicum Root.

The corm of *Colchicum autumnale* Linné (nat. ord. *Liliaceæ*).

COLCHICI SEMEN. *U. S.* Colchicum Seed.

The seed of *Colchicum autumnale* Linné (nat. ord. *Liliaceæ*).

The alkaloid *colchicine* is found in both the corm and seed of colchicum. It is the active principle. There are present in the root starch, gum, fat, sugar, resin, etc. In the seed a fixed oil is found in addition to the other principles. The toughness of the seeds is due to their composition and structure, being composed chiefly of horny albumen made up of cells having very thick walls and surrounded by a closely adherent testa. The seeds may be exhausted of their active principle by digesting them, without bruising or powdering them, in hot alcohol.

Official Preparations.

Extractum Colchici Radicis . . . . . . Extract of Colchicum Root.	Made with a menstruum of 35 parts of acetic acid and 150 parts of water (see page 447). Dose, one to two grains (0.06 to 0.13 Gm.).
Extractum Colchici Radicis Fluidum . Fluid Extract of Colchicum Root.	Made with 2 parts of alcohol and 1 part of water (see page 401). Dose, two to eight minims (0.12 to 0.5 C.c.).
Vinum Colchici Radicis . . . . Wine of Colchicum Root.	Made by percolating 400 Gm. of colchicum root with 150 C.c. of alcohol and 850 C.c. of white wine, to make 1000 C.c. (see page 382). Dose, ten minims (0.6 C.c.).
Extractum Colchici Seminis Fluidum . Fluid Extract of Colchicum Seed.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 402). Dose, two to eight minims (0.12 to 0.5 C.c.).
Tinctura Colchici Seminis . . . . . . Tincture of Colchicum Seed.	Made by percolating 150 Gm. of colchicum seed with a menstruum of 3 parts of alcohol and 2 parts of water, to make 1000 C.c. (see page 366). Dose, one-half fluidrachm (1.8 C.c.).
Vinum Colchici Seminis . . . . Wine of Colchicum Seed.	Made by percolating 150 Gm. of colchicum seed with 150 C.c. of alcohol and 850 C.c. of white wine, to make 1000 C.c. (see page 382). Dose, one-half fluidrachm (1.8 C.c.).

VERATRUM VIRIDE. *U. S.* Veratrum Viride. [AMERICAN HELLEBORE.]

The rhizome and roots of *Veratrum viride* Solander (nat. ord. *Liliaceæ*).

Veratrum viride contains the alkaloids *jervine*, *veratroidine*, *pseudojervine*, and *rubijervine*. It was supposed for many years to owe its activity to veratrine. There are also present resins, starch, coloring-matter, etc. It is a cardiac sedative, poisonous, with emetic and diaphoretic properties. Dose, one to two grains (0.06 to 0.13 Gm.).

Official Preparations.

Extractum Veratri Viridis Fluidum . Fluid Extract of Veratrum Viride.	Made with alcohol (see page 428). Dose, one to two minims (0.06 to 0.12 C.c.).
Tinctura Veratri Viridis . . . . . . Tincture of Veratrum Viride.	Made by percolating 400 Gm. of veratrum viride with sufficient alcohol to make 1000 C.c. (see page 380). Dose, two to four minims (0.12 to 0.24 C.c.).

VERATRINA. *U. S.* Veratrine.

A mixture of alkaloids obtained from the seed of *Asagræa officinalis* (Schlechtendal et Chamisso) Lindley (nat. ord. *Liliaceæ*).

Preparation.—The seeds are exhausted with alcohol, and the alcohol recovered by distillation. The residuary liquid contains veratrine in its natural combination with veratric acid; this is diluted with water

(which precipitates the resins) and filtered; potassa or ammonia is added to the filtrate, when veratrine is precipitated. It is then redissolved, decolorized, and reprecipitated. Veratrine is used externally, in neuralgia, rheumatism, etc. It is sternutatory and very poisonous.

Veratrina. U.S.	Odor and Taste.	Solubility.	
		Alcohol.	Other Solvents.
A white or grayish-white, amorphous or semi-crystalline powder, permanent in the air. When heated to 175° C. (347° F.) Veratrine melts, forming a light brown liquid. Upon ignition, it is consumed, leaving no residue.	Odorless, but causing intense irritation and sneezing when even a minute quantity reaches the nasal mucous membrane; acrid taste, leaving a sensation of tingling and numbness on the tongue; feebly alkaline reaction.	At 15° C. (59° F.), 3 parts. Boiling, Very soluble.	Very slightly soluble in cold or hot water, soluble in 6 parts of ether, and in 2 parts of chloroform.

Tests for Identity.

With nitric acid, Veratrine forms a yellow solution. On triturating Veratrine with concentrated sulphuric acid, in a glass mortar, the yellow or orange-red solution exhibits, by reflected light, a greenish fluorescence, which becomes more intense upon the addition of more acid, while the liquid is deep red by transmitted light.

On heating a small portion of Veratrine with a few C.c. of hydrochloric acid, the liquid will acquire a deep red color.

Official Preparations.

Oleatum Veratrinæ . . . Made by dissolving 2 Gm. of veratrine in 98 Gm. of oleic acid (see page 342). Used externally.
Oleate of Veratrine.

Unguentum Veratrinæ . Made by rubbing 4 Gm. of veratrine with 6 Gm. of olive oil and 90 Gm. of benzoinated lard. (See Unguenta.) Used externally.
Veratrine Ointment.

CHELIDONIUM. *U.S.* Chelidonium. [Celandine.]

The entire plant, *Chelidonium majus* Linné (nat. ord. *Papaveraceæ*).

Chelidonium contains *chelerythrine*, *chelidonine*, $C_{19}H_{17}N_3O_3$, *chelidoxanthin*, and *chelidonic acid*. It is bitter and acrid. Used as a diuretic. Dose, forty grains (2.6 Gm.).

SANGUINARIA. *U.S.* Sanguinaria. [Bloodroot.]

The rhizome of *Sanguinaria canadensis* Linné (nat. ord. *Papaveraceæ*), collected in autumn.

Sanguinaria contains *sanguinarine*, $C_{19}H_{17}NO_4$, a colorless alkaloid, which yields bright red salts: another alkaloid is present which as yet is unnamed. It also contains malic and citric acids, starch, resins, coloring-matter, etc. The liquid preparations invariably deposit a reddish precipitate upon the sides of the bottle. It is alterative, sternutatory, stimulant, and emetic. The dose is ten grains (0.6 Gm.).

Official Preparations.

Extractum Sanguinariæ Fluidum . Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 421). Dose, three to five minims (0.18 to 0.3 C.c.).
Fluid Extract of Sanguinaria.

Tinctura Sanguinariæ . . . . . . Made by percolating 150 Gm. of sanguinaria with a menstruum of 3 parts of alcohol and 2 parts of water with 2 per cent. of acetic acid, to make 1000 C.c. (see page 377). Dose, fifteen to thirty minims (0.9 to 1.8 C.c.).
Tincture of Sanguinaria.

STAPHISAGRIA. *U. S.* Staphisagria. [STAVESACRE.]

The seed of *Delphinium Staphisagria* Linné (nat. ord. *Ranunculaceæ*).

Staphisagria contains three alkaloids, *delphinine*, *delphisine*, and *delphinoidine*; also *staphisain*, with fixed oil, protein compounds, mucilage, etc. The alkaloids are soluble in chloroform, fixed oils, alcohol, and ether, and an oleoresin made with benzin is a good preparation. It is used principally externally, for killing body-vermin, and is very poisonous.

ACONITUM. *U. S.* Aconite.

The tuber of *Aconitum Napellus* Linné (nat. ord. *Ranunculaceæ*).

Aconite contains *aconitine*, $C_{33}H_{43}NO_{12}$, *isaconitine*, $C_{33}H_{43}NO_{12}$, and *pseudaconitine*, $C_{36}H_{49}NO_{11}$. *Aconine*, $C_{26}H_{39}NO_{11}$, and *pseudaconine*, $C_{27}H_{41}NO_8$, are products of hydrolysis.

Aconitic acid, $H_6C_6O_6$, is present, together with resins, sugar, fat, coloring-matter, etc. Aconitic acid may be produced by heating citric acid to 155° C. (311° F.). Alcohol is the best menstruum for preparations of aconite. Aconite is sedative and very poisonous. Dose, one grain (0.06 Gm.). The dose of aconitine is one three-hundredth of a grain (0.0002 Gm.).

Official Preparations.

Extractum Aconiti . . . . . Extract of Aconite.	Made with alcohol (see page 445). Dose, one-half grain (0.03 Gm.).
Extractum Aconiti Fluidum . Fluid Extract of Aconite.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 394). Dose, one-half to one minim (0.03 to 0.06 C.c.).
Tinctura Aconiti . . . . . . Tincture of Aconite.	Made by percolating 350 Gm. of aconite with a menstruum of 70 parts of alcohol and 30 parts of water, to make 1000 C.c. (see page 359). Dose, one to two minims (0.06 to 0.12 C.c.).

HYDRASTIS. *U. S.* Hydrastis. [GOLDEN SEAL.]

The rhizome and roots of *Hydrastis canadensis* Linné (nat. ord. *Ranunculaceæ*).

Hydrastis contains *hydrastine*, $C_{22}H_{23}NO_6$, *berberine*, $C_{20}H_{17}NO_4$, *xanthopuccine*, sugar, starch, resin, coloring-matter, etc. The salts of hydrastine are white, those of berberine are bright yellow. Hydrastis is used as an alterative and tonic, in doses of twenty to forty grains (1.3 to 2.6 Gm.).

Official Preparations.

Extractum Hydrastis Fluidum . Fluid Extract of Hydrastis.	Made with a menstruum of 6 parts of alcohol, 3 parts of water, and 1 part of glycerin (see page 410). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).
Tinctura Hydrastis . . . . . . Tincture of Hydrastis.	Made by percolating 200 Gm. of hydrastis with sufficient diluted alcohol to make 1000 C.c. (see page 369). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).
Glyceritum Hydrastis . . . . . Glycerite of Hydrastis.	Made by exhausting 1000 Gm. of hydrastis with alcohol, adding 250 C.c. of water, evaporating off the alcohol, adding 500 C.c. of glycerin and enough water to make 1000 C.c. (see page 320).

HYDRASTININÆ HYDROCHLORAS. *U. S.* Hydrastinine Hydrochlorate.

$C_{11}H_{11}NO_2HCl$; 224.97.

This is the hydrochlorate of an artificial alkaloid, *hydrastinine*, made by acting on colorless hydrastine with oxidizing agents. It was introduced into the U. S. P. 1890.

Hydrastininæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Light yellow, amorphous granules, or a pale yellow, crystalline powder, deliquescent on exposure to damp air. When heated to 178° C. (333.4° F.), the salt undergoes partial fusion, but does not liquefy. Upon ignition it is consumed, leaving no residue.	Odorless; bitter, saline taste; acid reaction.	At 15° C. (59° F.), 0.3 part.	Cold, 3 parts.	Difficultly soluble in ether or chloroform.

Tests for Identity.
A dilute, aqueous solution of the salt (up to about 1 in 100,000) has a decided blue fluorescence.
The salt dissolves in sulphuric acid with effervescence, coloring the acid yellowish-red.
An aqueous solution of the salt is not precipitated by ammonia water.
An aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid.
On adding to 2 C.c. of an aqueous solution of the salt (1 in 100) an excess of bromine water, a yellow precipitate is produced, which is dissolved by ammonia water to a nearly colorless liquid (difference from *hydrastine*, with which the ammonia produces a brick-red precipitate).

Uses.—Hydrastinine hydrochlorate is an oxytocic, in doses of one-half to one grain (0.03 to 0.06 Gm.).

MENISPERMUM. *U. S.* Menispermum. [Yellow Parilla. Canadian Moonseed.]

The rhizome and roots of *Menispermum canadense* Linné (nat. ord. *Menispermaceæ*).

Menispermum contains *menispine*, *berberine*, resin, starch, tannin, coloring-matter, etc. It is alterative and tonic, in doses of twenty to forty grains (1.3 to 2.6 Gm.).

Official Preparation.

Extractum Menispermi Fluidum . Fluid Extract of Menispermum.	Made with a menstruum of 2 parts of alcohol and 1 part of water (see page 414).

ASPIDOSPERMA. *U. S.* Aspidosperma. [Quebracho.]

The bark of *Aspidosperma Quebracho-blanco* Schlechtendal (nat. ord. *Apocynaceæ*).

This bark contains *aspidospermine*, *aspidospermatine*, *aspidosamine*, *quebrachine*, *hypoquebrachine*, and *quebrachamine*. It is used as an antiperiodic, in doses of ten to twenty grains (0.6 to 1.2 Gm.).

Official Preparation.

Extractum Aspidospermatis Fluidum . Fluid Extract of Aspidosperma.	Made with a menstruum of 2 parts of alcohol and 1 part of water with 10 per cent. of glycerin (see page 396). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).

GRANATUM. *U. S.* Pomegranate.

The bark of the stem and root of *Punica Granatum* Linné (nat. ord. *Lythrarieæ*).

Pomegranate contains four alkaloids, *pelletierine*, *isopelletierine*, *methylpelletierine*, *pseudopelletierine*. The latter is solid and crystallizable;

the others are liquid. It also contains punico-tannic acid, $C_{20}H_{16}O_{13}$, sugar, mannite, pectin, gum, etc. Pomegranate is anthelmintic, in doses of thirty grains (1.9 Gm.).

PAREIRA. *U. S.* Pareira. [PAREIRA BRAVA.]

The root of *Chondodendron tomentosum* Ruiz et Pavon (nat. ord. *Menispermaceæ*).

This root contains *pelosine*, or *cissampeline*. This has been proved to be identical with *buxine* and *beberine*, alkaloids obtained from *Buxus sempervirens* and *Nectandra Rodiæi*. Pareira is tonic, diuretic, and aperient. The dose is forty grains (2.6 Gm.).

Official Preparation.

Extractum Pareiræ Fluidum . Fluid Extract of Pareira.	Made with a menstruum of 72 parts of alcohol, 18 parts of water, and 10 parts of glycerin (see page 415). Dose, one fluidrachm (3.7 C.c.).

IPECACUANHA. *U. S.* Ipecac.

The root of *Cephaëlis Ipecacuanha* (Brotero) A. Richard (nat. ord. *Rubiaceæ*).

Ipecac contains *emetine*, $C_{28}H_{40}N_2O_5$, *ipecacuanhic acid*, pectin, starch, resin, sugar, etc. It is emetic and expectorant. The dose is five to thirty grains (0.3 to 1.8 Gm.). The apothegmatic matter which is dissolved by hydro-alcoholic liquids when percolating it, is slowly precipitated when added to water or syrup. It may be separated by allowing the aqueous liquid to stand until the separation is completed, and then filtering.

Official Preparations.

Extractum Ipecacuanhæ Fluidum . . Fluid Extract of Ipecac.	Made with a menstruum of 3 parts of alcohol and 1 part of water (see page 411). Dose, ten to thirty minims (0.6 to 1.8 C.c.).
Trochisci Ipecacuanhæ . . . . Troches of Ipecac.	Each troche contains about one-third grain of ipecac. (See Trochisci.)
Trochisci Morphinæ et Ipecacuanhæ . Troches of Morphine and Ipecac.	Each troche contains about one-fortieth grain of morphine and one-twelfth grain of ipecac.
Syrupus Ipecacuanhæ . . . . Syrup of Ipecac.	Made from 70 C.c. of fluid extract of ipecac, 10 C.c. of acetic acid, 100 C.c. of glycerin, 700 Gm. of sugar, and water to make 1000 C.c. (see page 306). Dose, thirty minims to two fluidrachms (1.8 to 7.4 C.c.).
Tinctura Ipecacuanhæ et Opii . . . . Tincture of Ipecac and Opium.	Made by evaporating 100 C.c. of deodorized tincture of opium to 80 C.c., and adding 10 C.c. of fluid extract of ipecac and sufficient diluted alcohol to make 100 C.c. (see page 370). Dose, ten minims (0.6 C.c.).
Vinum Ipecacuanhæ . . . . Wine of Ipecac.	Made by mixing 100 C.c. of fluid extract of ipecac with 100 C.c. of alcohol and 800 C.c. of white wine (see page 383). Dose, one fluidrachm (3.7 C.c.).
Pulvis Ipecacuanhæ et Opii . . . . . Powder of Ipecac and Opium.	Made by triturating together 10 Gm. of powdered ipecac, 10 Gm. of powdered opium, and 80 Gm. of powdered sugar of milk. (See Pulveres.) Dose, ten grains (0.6 Gm.).

COCA. *U. S.* Coca.

[ERYTHROXYLON, PHARM. 1880.]

The leaves of *Erythroxylon Coca* Lamarck (nat. ord. *Lineæ*).

Erythroxylon contains *cocaine*, $C_{17}H_{21}NO_4$, and *hygrine*, combined with cocatannic acid. Coca is a nervous stimulant, with diaphoretic

properties. Cocaine is remarkable for its action as a local anæsthetic when applied to mucous membranes. The dose of coca is from thirty to sixty grains (1.9 to 3.8 Gm.). (See U. S. Dispensatory, 17th edition, page 417.)

Official Preparation.

Extractum Cocæ Fluidum . . . . . Made with diluted alcohol (see page 401). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.).
Fluid Extract of Coca.

COCAINÆ HYDROCHLORAS. *U. S.* Cocaine Hydrochlorate.

$C_{17}H_{21}NO_4HCl$; 338.71.

The hydrochlorate of an alkaloid obtained from Coca.

The alkaloid cocaine and its salts are now mostly made in South America at points adjacent to the habitat of the drug.

Cocainæ Hydrochloras. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
Colorless, transparent crystals, or a white crystalline powder, permanent in the air.	Odorless; saline, slightly bitter taste, producing upon the tongue a tingling sensation, followed by numbness of some minutes' duration; neutral reaction.	At 15° C. (59° F), 0.48 part. Boiling, Very soluble.	Cold, 3.5 parts. Boiling, Very soluble.	Soluble in 2800 parts of ether or in 17 parts of chloroform.

Tests for Identity and Quantitative Tests.	Impurities.	Tests for Impurities.
The prolonged application of heat to the salt or to its solution induces decomposition. At 193° C. (379.4° F.) the salt melts with partial sublimation, forming a light brownish-yellow liquid. When ignited, it is consumed without leaving a residue.	Water of Crystallization.	On heating a small quantity of the powdered salt for twenty minutes, at a temperature of 100° C. (212° F.), it should not suffer any material loss.
On adding 5 drops of a 5-per-cent. solution of chromic acid to 5 C.c. of a 2-per-cent. solution of Cocaine Hydrochlorate, a yellow precipitate is produced which redissolves on shaking; on now adding 1 C.c. of hydrochloric acid, a permanent orange-yellow precipitate will be formed. If a small quantity of the salt be rubbed, with a glass rod, on a dry, white porcelain surface, with an equal bulk of mercurous chloride, and the mixture then breathed upon, it will acquire a dark gray, or grayish-black, color. The aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid.	Cinnamyl-Cocaine and some other Bases derived from Coca.	If 1 drop of a mixture of 1 volume of decinormal potassium permanganate V.S. and two volumes of water be added to 5 C.c. of a 2-per-cent. solution of Cocaine Hydrochlorate, mixed with 3 drops of diluted sulphuric acid, and contained in a small, clean glass-stoppered vial, the pink tint produced by the permanganate should not entirely disappear within half an hour.
The addition of sulphuric or nitric acid to the salt, at the ordinary temperature, should develop no color.		

Uses.—Cocaine hydrochlorate is used as a local anæsthetic and cerebral stimulant. The dose is from one-quarter to one grain (0.016 to 0.065 Gm.).

GUARANA. *U.S.* Guarana.

A dried paste chiefly consisting of the crushed or pounded seeds of *Paullinia Cupana* Kunth (*Paullinia sorbilis* Martius; nat. ord. *Sapindaceæ*).

Guarana contains caffeine, $C_8H_{10}N_4O_2$, and about 25 per cent. of tannin, with resin, mucilage, starch, volatile oil, saponin, etc. It is used as a nervous stimulant, in doses of thirty to sixty grains (1.9 to 3.8 Gm.). It is effective only in comparatively large doses.

Official Preparation.

Extractum Guaranæ Fluidum. Fluid Extract of Guarana.	Made with 3 parts of alcohol and 1 part of water (see page 409). Dose, one to two fluidrachms (3.7 to 7.4 C.c.).

CAFFEINA. *U.S.* Caffeine.

$C_8H_{10}N_4O_2 + H_2O$; 211.68. [THEINE.]

A feebly basic, proximate principle, obtained from the dried leaves of *Thea sinensis* Linné (nat. ord. *Ternstrœmiaceæ*), or from the dried seeds of *Coffea arabica* Linné (nat. ord. *Rubiaceæ*), and found also in other plants.

Caffeine is usually prepared from tea or coffee by precipitating a decoction with lead acetate, removing the excess of lead from the filtrate by hydrogen sulphide, adding ammonia water, evaporating, and recrystallizing.

Caffeina. *U.S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
Fleecy masses of flexible crystals, generally quite long, and of a silky lustre, permanent in the air.	Odorless; bitter taste; neutral reaction.	At 15° C. (59° F.), 80 parts. Boiling, About 2 parts.	Cold, 33 parts. Boiling, Very soluble.	In 7 parts of chloroform, and in 555 parts of ether.

Tests for Identity.	Impurities.	Tests for Impurities.
When heated to 100° C. (212° F.), Caffeine loses its water of crystallization, and at 229° C. (444.2° F.) it melts, forming a colorless liquid. When ignited, Caffeine is completely volatilized without charring or leaving a residue. On dissolving a small quantity of Caffeine in concentrated sulphuric acid, and adding a minute fragment of potassium dichromate to the liquid, the latter will acquire a yellowish-green color, which gradually becomes green. If a small quantity of Caffeine be dissolved in about 1 C.c. of hydrochloric acid, a little potassium chlorate added, the whole evaporated to dryness on a water-bath, and the capsule then inverted over a vessel containing a few drops of ammonia water, the residue will acquire a rich purple color, which is destroyed by alkalies.	Organic Impurities. Other Alkaloids.	Caffeine should dissolve in strong sulphuric or nitric acid without producing a color. Its aqueous solution should not be precipitated by mercuric potassium iodide T.S.

Uses.—Caffeine is a nervous stimulant. It is chiefly used in nervous headaches of a certain type. The dose is from one to three grains (0.06 to 0.19 Gm.).

CAFFEINA CITRATA. *U. S.* Citrated Caffeine.

	Metric.	Old form.
Caffeine	50 Gm.	1 oz. av.
Citric Acid	50 Gm.	1 oz. av.
Distilled Water, hot	100 C.c.	2 fl. oz.

Dissolve the Citric Acid in the hot Distilled Water, add the Caffeine, and evaporate the resulting solution, on a water-bath, to dryness, constantly stirring towards the end of the operation. Reduce the product to a fine powder and transfer it to well-closed bottles.

This is not a definite chemical salt, but a mixture of caffeine and citric acid, caffeine being a feeble alkaloid: hence the common name *citrate of caffeine* is improper. It is used as a cerebral stimulant in doses of three to eight grains (0.19 to 0.5 Gm.).

A white powder, odorless, having a purely acid taste and an acid reaction. One part of Citrated Caffeine forms a clear, syrupy solution with about 3 parts of water. Upon dilution with water this yields a white precipitate (caffeine), which redissolves when about 25 parts of water have been added. It is also soluble in a mixture of 2 volumes of chloroform and 1 volume of alcohol.

CAFFEINA CITRATA EFFERVESCENS. *U. S.* Effervescent Citrated Caffeine.

	Metric.	Old form.
Caffeine	10 Gm.	70 grains.
Citric Acid	10 Gm.	70 grains.
Sodium Bicarbonate	330 Gm.	5 oz. av. 122 grains.
Tartaric Acid	300 Gm.	5 oz. av.
Sugar, in very fine powder	350 Gm.	5 oz. av. 262 grains.
Alcohol, a sufficient quantity,		
To make	1000 Gm.	or about 16 oz. av.

Triturate the solid ingredients, separately well dried, to a fine, uniform powder. Mix this with Alcohol to a soft paste, and rub it through a No. 6 tinned-iron sieve or enamelled colander. Then dry it, and reduce it to a coarse, granular powder. Keep the product in well-stoppered bottles. This effervescent salt is used for preparing a pleasant stimulating draught by adding a teaspoonful to four fluid-ounces of water.

CONIUM. *U. S.* Conium. [HEMLOCK.]

The full-grown fruit of *Conium maculatum* Linné (nat. ord. *Umbelliferæ*), gathered while yet green.

Conium contains *coniine*, $C_8H_{17}N$, *conhydrine*, $C_8H_{17}NO$, and *methyl-coniine*, $C_8H_{16}CH_3N$; also a little volatile oil and fixed oil. Coniine is a liquid volatile alkaloid, and contains no oxygen. Its odor resembles that of the urine of mice. It is soluble in water, alcohol, and ether. Conium is narcotic and sedative. Dose, five grains (0.3 Gm.).

Official Preparations.

Extractum Conii . . . . . . Made with diluted alcohol containing 2 per cent. of acetic acid to fix the alkaloid (see page 448). Dose, one-half to one grain (0.03 to 0.06 Gm.).
Extract of Conium.

Extractum Conii Fluidum . Made with diluted alcohol containing 2 per cent. of acetic acid to fix the alkaloid (see page 402). Dose, five to twenty minims (0.3 to 1.2 C.c.).
Fluid Extract of Conium.

SCOPARIUS. *U. S.* Scoparius. [BROOM.]

The tops of *Cytisus Scoparius* (Linné) Link (nat. ord. *Leguminosæ*).

Scoparius contains *sparteine*, a colorless liquid alkaloid, having the composition $C_{15}H_{26}N_2$. It also contains *scoparin*, $C_{21}H_{22}O_{10}$, which probably represents the diuretic and purgative action of the drug. The dose of scoparius in dropsical complaints is twenty to thirty grains (1.3 to 1.9 Gm.).

Official Preparation.

Extractum Scoparii Fluidum . Made with a menstruum of diluted alcohol (see page 423). Fluid Extract of Scoparius. Dose, twenty to forty minims (1.2 to 2.4 C.c.).

SPARTEINÆ SULPHAS. *U. S.* Sparteine Sulphate.

$C_{15}H_{26}N_2H_2SO_4 + 4H_2O$; 403.23.

The neutral sulphate of an alkaloid obtained from Scoparius.

The salts of sparteine are mostly crystallizable, although the alkaloid itself is liquid.

Sparteinæ Sulphas. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
Colorless, white, prismatic crystals, or a granular powder, liable to attract moisture when exposed to damp air. When heated to about 83° C. (181.4° F.), the salt begins to lose its water of crystallization, all of which escapes at 100° C. (212° F.). At about 136° C. (276.8° F.) it melts, and upon ignition it is consumed, leaving no residue.	Odorless, and having a saline, somewhat bitter taste, and a neutral reaction.	Very soluble.	Very soluble.

Tests.
If 25 C.c. of ether be added to about 0.1 Gm. of Sparteine Sulphate in a test-tube, then a few drops of dilute ammonia water, so that the latter shall not be in excess, and an ethereal solution of iodine (1 in 50) be afterwards added until the liquid, when shaken, turns from an orange to a dark reddish-brown color, the bottom and sides of the test-tube will after a short time be found coated with minute, dark greenish-brown crystals, distinctly seen with a lens after the liquid has been poured out.
On shaking 0.05 Gm. of the salt, in a test-tube, with 5 C.c. of potassium or sodium hydrate T.S., the liquid will at first be turbid, and small drops of sparteine will gradually collect on the surface. If a strip of moistened red litmus paper be suspended in the mouth of the test-tube, and a gentle heat be then applied, the test-paper will gradually acquire a blue color, but no ammoniacal odor should be perceptible (absence of *ammonium salts*).

LOBELIA. *U. S.* Lobelia.

The leaves and tops of *Lobelia inflata* Linné (nat. ord. *Lobeliaceæ*), collected after a portion of the capsules have become inflated.

Lobelia contains *lobeline*, *lobelic acid*, *lobelacrin*, wax, resin, gum, etc. Lobeline, the alkaloid, is liquid, and contains no oxygen. Lobelia is expectorant and emetic. Dose, ten to forty grains (0.6 to 2.6 Gm.).

Official Preparations.

Extractum Lobeliæ Fluidum . Made with diluted alcohol (see page 413). Dose, ten to twenty minims (0.6 to 1.2 C.c.). Fluid Extract of Lobelia.

Tinctura Lobeliæ . . . . . . Made by percolating 200 Gm. of lobelia with sufficient diluted alcohol to make 1000 C.c. (see page 372). Dose, one-half to one fluidrachm (1.8 to 3.7 C.c.). Tincture of Lobelia.

TABACUM. *U.S.* Tobacco.

The commercial, dried leaves of *Nicotiana Tabacum* Linné (nat. ord. *Solanaceæ*).

Tobacco contains *nicotine*, $C_{10}H_{14}N_2$, a liquid alkaloid, which is colorless, very acrid, poisonous, and rapidly turns brown on exposure to air. It is soluble in water, alcohol, and ether. Tobacco is sedative and emetic. Dose, one to five grains (0.06 to 0.3 Gm.).

Unofficial Drugs containing Alkaloids.

Akazga (Boundou, Quai, Ikaga, Icaya).	An ordeal poison, used in a district on the West Coast of Africa. The alcoholic extract acts similarly to nux vomica.
Alstonia Constricta. Australian Fever Bark.	The bark of *A. constricta*, found in Australia. It contains *alstonine*, which is very bitter.
Baptisia. Baptisia.	The root of *B. tinctoria*, found in North America. It contains an alkaloid and *baptisin*, which is an impure resin, containing some of the alkaloid.
Berberis. Barberry Bark.	From *B. vulgaris*, found in Europe and America. It contains *berberine*, *oxyacanthine*, and *tannin*.
Boldus. Boldo.	The leaves of *Peumus B.*, found in Chili. It contains *boldine*, volatile oil, tannin, etc.
Cactus Grandiflora. Night-blooming Cereus.	Cardiac stimulant. Dose of a tincture of the fresh stems (4 oz. to 1 pint), thirty minims (1.85 C.c.) every four hours.
Caffea. Coffee.	The seeds of *C. arabica*, found in most tropical countries. It contains about 1 per cent. of *caffeine*, $C_8H_{10}N_4O_2.H_2O$, and fixed oil.
Celastrus.	Stimulant and alterative. Various species of the Celastraceæ have medicinal properties.
Cocculus Indicus. Fish-berries.	The fruit of *Anamirta C.*, found in the East Indies. It contains *menispermine*, *picrotoxin*, etc.
Colchici Flores. Colchicum Flowers.	The flowers of *Colchicum autumnale*, found in Europe. They contain a large percentage of *colchicine*.
Coptis. Goldthread.	The plant of *C. trifolia*, found in North America. It contains a yellow crystalline alkaloid, *berberine*, and a white one, named *coptine*.
Coptis Teeta. East Indian Goldthread.	The rhizome of *C. Teeta*, found in East India. It contains a very large percentage of *berberine*.
Corydalis. Turkey Corn.	The tubers of *Dicentra canadensis*, grown in North America. It contains the alkaloid *corydaline*, which is very bitter, acrid resin, etc.
Curare. Wourari.	An extract made by South American Indians from plants belonging to the genus *Strychnos*. It contains an extremely poisonous alkaloid, named *curarine*.
Cytisus Laburnum. Laburnum.	Poisonous, narcotic. It contains *cytisine* ($C_{20}H_{27}N_3O$) and *laburine*.
Delphinium. Larkspur Seed.	The seed of *D. consolida*, found in Central Europe. It contains the poisonous alkaloid *delphinine*.
Dita. Dita Bark.	From the bark of *Alstonia scholaris*, found in the Philippine Islands. It contains $\frac{1}{50}$ per cent. of a bitter alkaloid, *ditamine*, and 2 per cent. of *ditain*, an uncrystallizable bitter substance.
Duboisia. Duboisia.	The leaves of *D. myoporoides*, found in Australia. It contains a very poisonous alkaloid, *duboisine*, which is colored reddish-brown by sulphuric acid.
Ephedra Vulgaris.	A cardiac stimulant and local mydriatic. It contains the alkaloid *ephedrine*.
Erythrophlœum. Sassy Bark.	The bark of *E. guineense*, found in Africa. It contains the colorless alkaloid *erythrophleine*. Emetic, narcotic, and astringent. Dose of the extract, $\frac{1}{4}$ to $\frac{1}{3}$ grain (0.015 to 0.02 Gm.).
Eschscholtzia Californica. Chamisso.	Soporific and analgesic. It contains a glucoside and an alkaloid, said to be *morphine*. The extract has been given in doses commencing with 12.3 grains (0.8 Gm.), increasing to 185 grains (12 Gm.) a day.
Fumaria Officinalis. Fumitory.	The plant of *F. officinalis*, found in Europe. It contains the alkaloid *fumarine*.
Glaucium. Horn Poppy.	The plant of *G. luteum*. It contains the alkaloids *sanguinarine*, *glaucine*, and *glaucopicrine*.
Gloriosa Superba.	An acrid, narcotic poison. It contains two resins and a very poisonous bitter principle, "superbine."
Ignatia. Bean of St. Ignatius.	The seed of *Strychnos Ignatii* (nat. ord. *Loganiaceæ*).

Unofficial Drugs containing Alkaloids.—*Continued.*

Isopyrum Thalictroides.	It contains two alkaloids, *isopyrine* and *pseudo-isopyrine*.
Jeffersonia Diphylla. Twin-Leaf.	Tonic, expectorant, and emetic. It is used as a substitute for senega.
Manaca.	A portion of the root and stem of *Franciscea uniflora*, a Brazilian plant. Antirheumatic, given in the form of fluid extract, in the dose of ten to thirty drops, three times a day.
Mandragora Officinalis. Mandrake.	Anæsthetic. It contains an alkaloid, *mandragorine*, and another alkaloid, both of which possess mydriatic properties.
Muawin Bark.	An ordeal poison. It contains an alkaloid, *muawinum*.
Rhœas. Red Poppy.	The petals of *Papaver R.*, cultivated. They contain the alkaloid *rhœadine* and some coloring-matter.
Sophora Speciosa.	The poisonous seeds of this tree contain a volatile liquid alkaloid, *sophorine*.
Sterculia Acuminata.	The nuts of this tree (kola nuts) contain caffeine. They are a cardiac stimulant.
Tayuya Ficifolia.	It contains two alkaloids, *trianospermine* and *trianospermatine*, and a bitter principle, "tayuyin."
Veratrum Album. White Veratrum.	The rhizome of *V. album*, found in Europe. It contains the alkaloids *jervine*, $C_{26}H_{37}NO_3$, *pseudojervine*, *rubijervine*, *veratralbine*, etc.
Xanthorrhiza. Yellow Root.	Tonic. Dose, forty grains (2.6 Gm.). It contains berberine.

Unofficial Alkaloids and their Salts.

Aconitine, $C_{33}H_{43}NO_{12}$.	From *Aconitum Napellus*. It exists in an amorphous and crystalline form; inodorous, and of a bitter and acrid taste; sparingly soluble in water, but freely so in alcohol, ether, and chloroform. Used principally for neuralgia, in the form of an ointment. A most violent poison. Commercial aconitine is very variable in quality. Dose of the pure alkaloid, one-six-hundred-and-fortieth of a grain (0.0001 Gm.).
Alstonine, $C_{21}H_{20}N_2O_4$.	From the bark of *Alstonia constricta*. A brownish-yellow, amorphous powder, readily soluble in alcohol.
Anagyrine, $C_{14}H_{18}N_2O_2$.	A yellowish, amorphous, hygroscopic, poisonous alkaloid, from *Anagyris fœtida*. Soluble in water, alcohol, and ether.
Analgen (Ortho-ethoxy-anomonobenzoylamidochinoline), $C_{18}H_{16}N_2O_2$.	Antipyretic and antirheumatic. Dose, seven and five-tenths to fifteen grains (0.5 to 0.97 Gm.), repeated, if necessary, to seventy-five grains (4.86 Gm.) a day.
Antispasmin (Narcein Sodium, Sodium Salicylate).	Hypnotic and analgesic. Dose, one-half to one grain (0.032 to 0.065 Gm.).
Aspidospermine, $C_{22}H_{30}N_2O_2$.	From the bark of *Aspidosperma Quebracho*. It is a weak base, forming amorphous salts. The hydrochlorate is given in doses of one-thirtieth to one-twentieth of a grain (0.002 to 0.003 Gm.).
Beberine, $C_{18}H_{21}NO_3$.	From the bark of *Nectandra Rodiœi*. A pale yellow, amorphous powder, of a resinous aspect, inodorless, very bitter, very slightly soluble in water, inflammable, and of an alkaline reaction. *Beberine sulphate* is given in doses of two to five grains (0.13 to 0.3 Gm.).
Benzoyl Ecgonine, $C_{16}(H).H_{18}NO_4$, or $C_9H_{14}(C_7H_6O)NO_3$.	Cardiac stimulant. Prepared by heating cocaine in aqueous solution to decomposition.
Benzoyl Tropeine.	Local anæsthetic.
Berberine, $C_{20}H_{17}NO_4$.	From the bark of the root of *Berberis vulgaris* and others. It occurs in minute yellow crystals, has a bitter taste, is soluble in 100 parts of cold water, and insoluble in ether. Its medicinal action is similar to that of quinine. Dose, one to eight grains (0.06 to 0.5 Gm.).
Betaine Trimethylglycoll.	An alkaloid found in the juice of the sugar beet.
Boldine.	From the leaves of *Peumus Boldus*. It imparts to water a bitter taste, is soluble in alcohol, ether, chloroform, etc., and is colored red by nitric and sulphuric acids. The yield of alkaloid is about $\frac{1}{10}$ per cent.
Buxine.	From the bark of *Buxus sempervirens*. It is identical with the beberine of nectandra bark.
Chelerythrine.	From *Chelidonium majus*. This alkaloid is identical with sanguinarine. It is an acrid poison.

Unofficial Alkaloids and their Salts.—*Continued.*

Chinoidine (Quinoidine).	A mixture of alkaloids, mostly amorphous, obtained as a by-product in the manufacture of the crystallizable alkaloids from cinchona. Dose, five to thirty grains (0.3 to 1.9 Gm.).
Chinol, Chinoline monohypochlorite, $C_9H_6N.Cl.O$.	Antipyretic and analgesic. Dose, three to five grains (0.19 to 0.32 Gm.).
Chinoline (Quinoline, Leucoline), C_9H_7N.	An artificial alkaloid. A colorless, oily liquid. Sp. gr. 1.081 at 10° C. (50° F.). Antipyretic and antiseptic.
Chlorogenine.	Identical with *alstonine* (see above).
Cinchonidinæ Salicylas, Cinchonidine Salicylate, $C_{19}H_{22}N_2O.C_7H_6O_3$.	Antirheumatic. Dose, fifteen to twenty grains (0.971 to 1.29 Gm.) a day.
Cicutine.	From *Cicuta virosa.* A volatile alkaloid.
Cocaine (Erythroxyline), $C_{17}H_{21}NO_4$.	From the leaves of *Erythroxylon Coca.* Colorless prisms of a strong alkaline reaction, a bitter taste, producing a transient numbness upon the tongue, soluble in 700 parts of water, more soluble in alcohol and ether. It is decomposed on being heated with strong hydrochloric acid. Used largely as a local anæsthetic.
Colchicine, $C_{17}H_{19}NO_5$.	From *Colchicum autumnale.* It is colorless or yellow, amorphous, soluble in water, alcohol, and chloroform; has a saffron-like odor and a bitter taste. Its aqueous solution is colored yellow on the addition of hydrochloric acid. The yield of alkaloid is about ½ per cent. Used in gout, rheumatism, neuralgia, etc. Dose, one-hundredth of a grain (0.0006 Gm.) three times a day.
Conhydrine, $C_8H_{17}NO$.	From *Conium maculatum.* It occurs in pearly, iridescent plates, which are easily fusible; odor similar to that of coniine.
Coniine, $C_8H_{15}N$.	From *Conium maculatum.* A volatile alkaloid, inflammable, strong alkaline reaction, a strong odor, soluble in water, alcohol, ether, chloroform, etc. Used as an antispasmodic. Dose, one-fourth of a grain (0.016 Gm.). *Coniine hydrobromate* is given in doses of one-sixteenth of a grain (0.004 Gm.).
Corydaline.	From the tubers of *Dicentra canadensis.* A white, amorphous powder; its solution has a very bitter taste.
Curarine, $C_{18}H_{35}N$.	From *curare.* It occurs in colorless prisms having a very bitter taste. It is colored red by nitric acid.
Cytisine, $C_{20}H_{27}N_3O$.	From *Cytisus Laburnum.* It occurs in white crystals, is inodorous, and has a bitter, somewhat caustic taste, and an alkaline reaction. Soluble in water and alcohol. It is colored orange-yellow by nitric acid.
Daturine.	See page 1001. Dose, one-sixty-fourth of a grain (0.001 Gm.).
Delphinine, $C_{22}H_{35}NO_6$.	From the seed of *Delphinium Staphisagria.* It occurs in flat prisms; taste bitter, followed by persistent tingling. Nearly insoluble in water.
Duboisine.	From several species of *Duboisia.* It crystallizes in fine colorless needles. Used as a substitute for atropine. Dose, one-sixty-fourth of a grain (0.001 Gm.).
Emetine, $C_{28}H_{40}N_2O_5$.	From *Cephaëlis Ipecacuanha.* It is a yellowish-white powder, sparingly soluble in water, but dissolves in alcohol, ether, etc. Emetine is colored bright yellow or orange by chlorinated lime. The yield of alkaloid is about 1 per cent.
Erythrophleine Hydrochlorate.	Obtained from *Erythrophlæum guineense* (Sassy bark). Used in place of cocaine. Dose, one-eighth of a grain (0.008 Gm.).
Ethyl-oxy-Caffeine.	Called also Ethoxycaffeine. Given in migraine, in doses of six to eight grains (0.38 to 0.5 Gm.).
Fumarine.	From *Fumaria officinalis.* It occurs in a white, crystalline form, is of a bitter taste, scarcely soluble in water, but soluble in alcohol.
Geissospermine, $C_{19}H_{24}N_2O_2.H_2O$.	From *Geissospermum læve.* It occurs in small white prisms, nearly insoluble in ether and water, and readily soluble in alcohol and dilute acids.
Gelsemine, $C_{11}H_{19}NO_2$.	From *Gelsemium sempervirens.* It occurs in an amorphous, white powder, of a very bitter taste and an alkaline reaction, slightly soluble in cold water. It is colored red changing to purple when heated with sulphuric acid. *Gelsemine hydrochlorate* has been given in doses of one-sixteenth of a grain (0.004 Gm.).
Glaucine.	From *Glaucium luteum.* A white, crystalline powder.
Glaucopicrine.	From *Glaucium luteum.* A white, crystalline powder.
Guaranine.	From *Paullinia sorbilis.* Identical with caffeine.
Homatropine Hydrobromate.	Salt of a derivative of atropine. Dose, one-fourth of a grain (0.016 Gm.).

Unofficial Alkaloids and their Salts.—*Continued.*

Hydrastine, $C_{22}NH_{23}O_6$.	From *Hydrastis canadensis*. It occurs in white, shining, quadrangular prisms, soluble in alcohol, ether, and chloroform, insoluble in water. By adding nitric acid to a small portion of the alkaloid a red color is produced, and a brown-red by sulphuric acid. The yield of alkaloid is about 1½ per cent.
Hygrine.	From the leaves of *Erythroxylon Coca*. A volatile alkaloid, of a pale yellow color and a burning taste.
Hyoscine.	Obtained from *Hyoscyamus niger* in the process for obtaining hyoscyamine, and also by boiling hyoscyamine with baryta water, when decomposition takes place, forming hyoscine and hyoscinic acid. Dose, one-sixty-fourth of a grain (0.001 Gm.).
Jervine, $C_{30}H_{46}N_2O_3$.	From *Veratrum album*. It occurs, when pure, as a white powder, tasteless, insoluble in water and ether, but soluble in alcohol and chloroform.
Kairine, $C_{10}H_{13}NO.HCl.H_2O$.	The hydrochlorate of an artificial alkaloid prepared from chinoline. It occurs in commerce as a grayish or yellowish crystalline powder, having a slight phenol-like odor, and a saline, bitter, somewhat aromatic taste, Soluble in boiling water. Dose, fifteen grains (0.9 Gm.).
Kairoline, Tetrahydromethylquinoline, or Tetrahydroethylquinoline.	Antipyretic. The sulphates are the commercial salts.
Laurotetanine.	An alkaloid found in a number of plants belonging to the Laurineæ. A powerful poison, acting like strychnine.
Lobeline.	From *Lobelia inflata*. It is a volatile, yellow, somewhat aromatic liquid, having an acrid taste. Soluble in alcohol, ether, and fixed oils.
Lupinine, $C_{21}H_{40}N_2O_2$.	From different species of *Lupinus*. It occurs in colorless, rhombic prisms having a fruity odor and a very bitter taste.
Lupuline.	From *Humulus Lupulus*. A liquid alkaloid which has a strong coniine-like odor and an alkaline taste.
Menispermine, $C_{18}H_{24}N_2O_2$.	From *Cocculus indicus*.
Muscarine, $C_5H_{15}NO_3$.	From *Amanita muscaria*. A colorless, crystalline powder, very deliquescent, sparingly soluble in chloroform, and insoluble in ether.
Nicotine, $C_{10}H_{14}N_2$.	From *Nicotiana Tabacum*. A poisonous, oily liquid. It has an unpleasant tobacco-like odor, a burning taste, and a strongly alkaline reaction.
Oxyacanthine, $C_{32}H_{46}N_2O_{11}$.	From *Berberis vulgaris*. It is white, turning yellow on exposure to sunlight, having a bitter taste and an alkaline reaction. Soluble in 30 parts of boiling alcohol and in 1 part of cold alcohol, insoluble in water. Sulphuric acid colors it brown-red, turning to bright red on being heated.
Parthenine.	From *Parthenium Hysterophorus*. Used in doses of seven to ten grains (0.4 to 0.6 Gm.) in neuralgia.
Pelletierine, $C_8H_{15}NO$.	From *Punica Granatum*. A dextrogyrate liquid, easily soluble in water, alcohol, and ether, and especially so in chloroform. *Pelletierine Sulphate* and *Pelletierine Tannate* have been used as tænicides in doses of five grains (0.3 Gm.).
Pelosine.	From *Chondodendron tomentosum*. It is amorphous, insoluble in water, slightly soluble in ether.
Piturine, C_6H_8N.	From the leaves of *Duboisia Hopwoodii*. A colorless liquid, of a nicotine odor and an acrid taste; on exposure to light it turns yellow and brown; freely soluble in water, alcohol, etc.
Punicine.	Identical with Pelletierine. See above.
Quebrachine, $C_{21}H_{26}N_2O_3$.	From the bark of *Aspidosperma Quebracho*. It yields crystallizable salts, and is colored yellow by sunlight.
Sanguinarine, $C_{19}H_{17}NO_4$.	From *Sanguinaria canadensis*. It occurs in white crystals having a bitter, acrid taste; soluble in ether and alcohol.
Solanine.	From *Dulcamara* and other plants. Has been given in doses of one grain.
Sophorine.	From the seeds of *Sophora speciosa*. A poisonous alkaloid.
Staphisagrine, $C_{22}H_{33}NO_5$.	From *Delphinium Staphisagria*. It is amorphous, very soluble in ether and in 200 parts of water.
Thalline, Tetrahydroparaquinanisol, $C_9H_6H_4N(OCH_3)$.	A hæmostatic. The sulphate and tartrate are powerful antipyretics. Dose, from four to eight grains (0.259 to 0.518 Gm.).
Theine.	See Caffeine.
Theobromine, $C_7H_8N_4O_2$.	From *Theobroma Cacao*. It occurs in minute, colorless or white, bitter crystals, sparingly soluble in water, alcohol, and ether.
Veratroidine, $C_{51}H_{78}N_2O_{16}$.	From *Veratrum viride*. It is a white powder, of a bitter taste, soluble in alcohol, ether, chloroform, etc. It is colored yellow by sulphuric acid.

QUESTIONS ON CHAPTER LX.

ALKALOIDS.

What are alkaloids, chemically? Where are they found?
What are their distinctive features?
According to the adopted nomenclature, what is the last syllable of the names of alkaloids? What of the names of neutral principles?
Opium—What is opium? How and where is it obtained? How much dry extract should dried opium yield when exhausted with cold water and evaporated to dryness?
How much morphine should opium in its normal moist condition yield when assayed by the official process?
Powdered opium—What is the Latin name?
Of what degree of fineness is powdered opium, and at what temperature should it be dried? How much morphine should it contain?
How may powdered opium of higher percentage of morphine be brought to the proper strength? What is the official process for assaying it?
Deodorized opium—What quality of opium is directed to be used?
How is it prepared?
If opium having a higher percentage of morphine is used in this process, how may the proper quantity to be used be ascertained?
To what does opium owe its value?
How many alkaloids have been proved to exist in opium?
What acids are found combined with these alkaloids?
What other principles are also present?
Which of these alkaloids and their salts are official in the U. S. Pharmacopœia?
Which was the first alkaloid discovered? When and by whom was it discovered?
Morphine—What is the Latin official name?
Give formula in symbols and molecular weight.
What was its former official name?
Explain the objects and the steps in the process for preparing morphine.
Describe odor, taste, chemical reaction, and solubility. Give tests and use.
Morphine acetate—What is the Latin official name?
Give formula in symbols and molecular weight.
What was its former official name?
What happens if too much heat is used in evaporating the solution?
Is this salt a very permanent one? What change sometimes takes place?
How may its solubility be increased?
Describe odor, taste, chemical reaction, and solubility. Give tests and dose.
Morphine hydrochlorate—What is the Latin name?
Give formula in symbols and molecular weight. How may it be prepared?
Is this salt more stable than morphine acetate?
Describe odor, taste, chemical reaction, and solubility. Give tests and dose.
Morphine sulphate—What is the Latin name?
Give formula in symbols and molecular weight.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose? What are the official preparations?
How strong was the solution formerly official?
What is the strength of Magendie's solution?
Codeine—Give the Latin name, formula in symbols, and molecular weight.
How may it be prepared? Why is codeine used in preference to its salts?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the presence of morphine be detected?
Apomorphine hydrochlorate—How is it prepared? Give rationale of process.
Describe odor, taste, chemical reaction, and solubility. Give tests and dose.
Cinchona—What is its official definition?
Yellow cinchona—What is the Latin name? What is its synonyme?
Whence is it derived? How much quinine should it contain?
Red cinchona—What is the Latin name? What is its synonyme?
Whence is it derived? How much quinine should it contain?
Upon what does the value of cinchona bark depend?
How may the value be ascertained?

Give the process of the U. S. Pharmacopœia for its assay: first, for ascertaining the total amount of alkaloids; second, for ascertaining the amount of quinine.

How many alkaloids have been discovered in cinchona barks?

Have all of these been found in any one variety of bark?

Do they all exist naturally in the bark?

Which are the most important alkaloids?

What acids are found in cinchona bark? What other principles are found?

How are the artificial alkaloids chiefly produced?

Why is it difficult to preserve the galenical preparations of cinchona?

How may this difficulty be in a measure obviated?

What are the official preparations?

Quinine—Give Latin name, formula in symbols, and molecular weight.

How is it usually made?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matters; more than 1 per cent. of quinidine, and more than traces of cinchonine.

For what is it used?

Quinine sulphate—What is the Latin name? Give formula in symbols and molecular weight.

What was the former official name? Give the process.

How many quinine sulphates have been obtained?

Which of these are official in the U. S. Pharmacopœia?

What is the difference in chemical composition between quinine sulphate (U.S. Pharmacopœia) and quinine bisulphate?

What is the difference in chemical composition between quinine bisulphate and the acid sulphate?

Quinine sulphate—Describe odor, taste, chemical reaction, solubility, and tests.

How may the following impurities be detected?—viz.: Foreign organic matters; ammonium salts; more than 16.18 per cent. of water; absence of more than about 1 per cent. of cinchonidine or quinidine, and of more than traces of cinchonine.

What is the dose? How is it best given in the liquid form?

Quinine bisulphate—What is the Latin official name?

Give formula in symbols and molecular weight. How is it made?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matters; free water.

What advantage has this salt over the sulphate for use in medicine?

How much weaker is it than the sulphate?

Quinine hydrochlorate—What is the Latin name?

Give formula in symbols and molecular weight. How may it be made?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matter; sulphate. What is the dose?

Why is this salt preferable to quinine sulphate for hypodermic use?

Quinine hydrobromate—What is the Latin official name?

Give formula in symbols and molecular weight. How may it be made?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matters; free water; sulphate. What is the dose?

Quinine valerianate—What is the Latin official name?

Give formula in symbols and molecular weight.

How may it be made by double decomposition?

What special care must be observed in preparing this salt?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matters; sulphate.

Has this salt any special advantage over the sulphate? What is the dose?

Quinidine sulphate—What is the Latin official name?

Give formula in symbols and molecular weight. How is it obtained?

Describe odor, taste, chemical reaction, and solubility. Give tests for identity.

How may the following impurities be detected?—viz.: Foreign organic matters; more than small proportions of cinchonidine or quinine.

In what respects does quinidine differ from quinine? How does this salt compare in efficiency with quinine sulphate? What is the dose?

Cinchonine—What is the Latin official name?

Give formula in symbols and molecular weight. How may it be obtained?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: More than traces of quinine or quinidine; foreign organic matters. For what purposes is it used?
Cinchonine sulphate—What is the Latin official name?
Give formula in symbols and molecular weight. How is it obtained?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: More than traces of quinine sulphate or of quinidine sulphate; more than 6 per cent. of moisture; foreign organic matters. What is the dose?
Cinchonidine sulphate—What is the Latin official name?
Give formula in symbols and molecular weight.
How is it obtained? Which barks contain most of it?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: More than traces of quinine sulphate or of quinidine sulphate; foreign organic matters; more than 8 per cent. of moisture; more than 0.5 per cent. of cinchonine sulphate, or more than 1.5 per cent. of quinidine sulphate. What is the dose?
Nux vomica—What is its definition? What does it contain?
In what is brucine soluble? What action does nitric acid have upon it?
What action does chlorine water have upon it?
Are the alkaloids soluble in the fixed oil? How may they be separated from it?
What is the dose? What are its official preparations?
Strychnine—Give the Latin name, formula in symbols, and molecular weight.
Describe odor, taste, chemical reaction, solubility, and tests.
How may the following impurity be detected?—viz.: More than traces of brucine.
Strychnine sulphate—Give formula in symbols and molecular weight.
How is it prepared? Describe taste, chemical reaction, and solubility.
Why is the sulphate more useful than the alkaloid? What is the dose?
Gelsemium—Give its synonyme and definition. What does it contain?
What is the best solvent for its active principles? What is the dose?
What are the official preparations?
Physostigma—What is its synonyme? Whence is it derived? What does it contain?
What is the dose? What are its official preparations?
What are the physical properties of physostigmine?
Physostigmine salicylate—How may it be made?
Describe taste, chemical reaction, and solubility.
What advantages does this salt possess over the alkaloid? What is the dose?
Belladonna leaves—What is the definition?
Belladonna root—What is the definition?
To what does belladonna owe its activity?
What is the dose? What are its official preparations?
Atropine—Give the Latin name, formula in symbols, and molecular weight.
How may it be prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose? Why is the sulphate preferred?
Atropine sulphate—How may it be prepared? Describe odor, taste, chemical reaction, and solubility. Give tests for identity. What is the dose?
Hyoscyamus—What is its synonyme? What is its definition?
What does it contain? What is the dose? What are the official preparations?
What salt prepared from it is official? What are the properties of hyoscine?
Hyoscyamine sulphate—What is the Latin official name?
Give formula in symbols and molecular weight. How is it prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests and dose.
Stramonium leaves—Whence are they derived?
Stramonium seed—Whence is it derived?
What do the leaves contain? What do the seeds contain?
What is the dose? What are the official preparations?
Dulcamara—What is its synonyme? Whence is it derived? What does it contain?
Which is the bitter and sweet principle? What are the official preparations?
Pilocarpus—What is its synonyme? Whence is it derived? What does it contain?
Is it easily powdered? What is the dose? What are the official preparations?
Pilocarpine hydrochlorate—Give the Latin name, formula in symbols, and molecular weight. How is it prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests and dose.

Colchicum root—Whence is it derived?
Colchicum seed—Whence is it derived? What is the active principle?
What does the root contain? What do the seeds contain?
Why are the seeds so tough? How may they be exhausted of their active principle?
What are the official preparations?
Veratrum viride—What is its synonyme? Whence is it derived?
What does it contain? To what was it formerly supposed to owe its activity?
What is the dose? What are the official preparations?
Veratrine—Whence is it obtained, and how is it prepared?
What are its properties and uses? Describe odor, taste, chemical reaction, solubility, and tests for identity. What are its official preparations?
Chelidonium—What is its synonyme?
What does it contain? What are its properties? What is the dose?
Sanguinaria—What is its synonyme? What is its definition?
What does it contain? What is the dose? What are its official preparations?
Staphisagria—What is its synonyme? Whence is it derived?
What does it contain? What are good solvents? For what is it used?
Aconite—Whence is it derived? What does it contain?
How may aconitic acid be produced?
What is the best menstruum for preparations of aconite?
What is the object of using tartaric acid in the menstruum?
What are its properties and dose?
What is the dose of aconitine? What are its official preparations?
Hydrastis—What is its synonyme? What is its definition? What does it contain?
What difference in appearance is there between the salts of hydrastine and those of berberine? What is the dose? What are its official preparations?
Menispermum—What is its synonyme? Whence is it derived?
What does it contain? What is the dose?
Pomegranate—What is the Latin official name? Whence is it derived?
What does it contain? Which of the alkaloids is solid and crystallizable?
Which of the alkaloids are liquid? What is the dose?
Pareira—What is its synonyme? Whence is it derived?
What does it contain?
With what is this alkaloid identical?
What is the dose? What are its official preparations?
Ipecacuanha—Whence is it derived? What does it contain?
What is the dose? What are its official preparations?
How may the apothegmatic matter which is dissolved by hydro-alcoholic liquids be separated?
Erythroxylon—What is its synonyme? Whence is it derived?
What does it contain?
What is the dose?
What are its official preparations?
What remarkable property does cocaine possess?
Guarana—What is it, and whence is it derived? What does it contain?
What is the dose?
What are its official preparations?
Caffeine—What is the Latin name?
Give formula in symbols and molecular weight. Whence is it obtained?
How is it prepared?
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
How may the presence of other alkaloids be detected?
What is the dose?
Conium—What is its synonyme? What is its definition?
What does it contain?
What are the peculiarities of coniine?
In what is coniine soluble?
What are the properties and dose of conium?
What are its official preparations?
Lobelia—What is its definition? What does it contain?
What is the dose?
What are its official preparations?
Tobacco—What is the Latin official name? Whence is it derived?
What does it contain? What are the properties of nicotine?
What are the properties and the dose of tobacco?

CONDENSED CHART OF THE VEGETABLE OFFI

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Algæ.				
Chondrus . . .	C. crispus and Gigartina mamillosus.	Carragheen. Irish Moss.	Whole plant.	North Atlantic coast.
Anacardieæ.				
Mastiche . . .	Pistacia Lentiscus.		Concrete resinous exudation.	Mediterranean basin.
Rhus Glabra .	Rhus glabra.		Fruit.	North America.
Rhus Toxicodendron . .	R. radicans.	Poison Ivy.	Fresh leaves.	North America.
Apocynaceæ.				
Apocynum . .	A. cannabinum.	Canadian Hemp.	Root.	United States.
Aspidosperma .	A. Quebracho-blanco.	Quebracho.	Bark.	Argentine Republic.
Strophanthus .	S. hispidus.		Seed.	Tropical Africa.
Aristolochiaceæ.				
Serpentaria . .	Aristolochia S. and A. reticulata.	Virginia Snakeroot.	Rhizome and roots.	United States.
Aroideæ.				
Calamus . . .	Acorus C.	Sweet Flag.	Rhizome.	
Asclepiadeæ.				
Asclepias . . .	A. tuberosa.	Pleurisy Root.	Root.	United States.
Berberidaceæ.				
Caulophyllum .	C. thalictroides.	Blue Cohosh.	Rhizome and roots.	North America.
Podophyllum .	P. peltatum.	May-Apple.	Rhizome and roots.	North America.
Betulaceæ.				
Oleum Betulæ Volatile . .	Betula lenta.	Oil of Sweet Birch.	Volatile oil from bark.	
Burseraceæ.				
Myrrha	Commiphora M.		Gum-resin.	East Africa and Arabia.
Caprifoliaceæ.				
Sambucus . .	S. canadensis.	Elder.	Flowers.	North America.
Viburnum Opulus	V. opulus.	Cramp Bark.	Bark.	United States.
Viburnum Prunifolium . .	V. prunifolium.		Bark.	United States.

CIAL DRUGS, WITH THEIR PREPARATIONS.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Chondrus.	Demulcent.	Mucilaginous compounds, etc.	
Mastic.	Stimulant.	Volatile oil, mastichic acid, masticin.	Pills of Aloes and Mastic.
Rhus Glabra.	Diuretic.	Acid calcium and potassium malates, tannin.	**Fluid Extract.**
Rhus Toxicodendron.	Irritant; rubefacient; gr. ij–v.	Toxicodendric acid, tannin, fixed oil, wax, mucilage.	
Apocynum.	Antiperiodic, emetic; gr. v–xx.	Tannin, resin, apocynin, etc.	**Fluid Extract.**
Aspidosperma.	Tonic, antispasmodic; gr. xv–ʒj.	Aspidospermine, quebrachine, etc.	**Fluid Extract.**
Strophanthus.	Sedative; ♏ iv–viij.	Kombic acid, strophanthin.	**Tincture.**
Serpentaria.	Stimulant; gr. xx.	Volatile oil, acorin, resin.	**Fluid Extract, Tincture,** Compound Tincture of Cinchona.
Calamus.			**Fluid Extract.**
Asclepias.	Expectorant; gr. xxx.	Tannin, resins, etc.	**Fluid Extract.**
Caulophyllum.	Antispasmodic; gr. xx.	Saponin, resins.	
Podophyllum.	Cathartic; gr. xx.	Resin, starch, sugar.	**Extract, Fluid Extract, Resin.**
Volatile Oil of Betula.			
Myrrh.	Stimulant, tonic; gr. xx.	Volatile oil, resin, gum, bitter principle.	**Tincture,** Compound Iron Mixture, Pills of Aloes and Myrrh, Tincture of Aloes and Myrrh, Compound Pills of Rhubarb.
Sambucus.	Diaphoretic; gr. lx.	Volatile oil, resin, mucilage.	
Viburnum Opulus.		Valerianic acid, etc.	**Fluid Extract.**
Black Haw.	Antidysmenorrhœic; gr. lx.	Valerianic acid, resin, tannin.	**Fluid Extract.**

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Celastraceæ.				
Euonymus . .	E. atropurpureus.	Wahoo.	Bark of root.	United States.
Chenopodiaceæ.				
Chenopodium .	C. ambrosioides, var. anthelminticum.	American Wormseed.	Fruit.	North America.
Oleum Chenopodii	C. ambrosioides, var. anthelminticum.	Oil of American Wormseed.	Volatile oil.	
Compositæ.				
Absinthium . .	Artemisia A.	Wormwood.	Leaves and tops.	Northern Asia and naturalized.
Anthemis . . .	A. nobilis.	Chamomile.	Flower-heads.	Southern and Western Europe.
Arnicæ Flores .	Arnica montana.		Flower-heads.	Mts. of Europe.
Arnicæ Radix .	Arnica montana.		Rhizome and root.	Mts. of Europe.
Calendula . .	C. officinalis.	Marigold.	Florets.	S. Europe, cult.
Eupatorium . .	E. perfoliatum.	Thorough-wort.	Leaves and flowering tops.	North America.
Grindelia . . .	G. robusta and G. squarrosa.		Leaves and flowering tops.	North America.
Inula	I. Helenium.	Elecampane.	Root.	C. and S. Europe.
Lactucarium .	Lactuca virosa.		Concrete milk-juice.	C. and S. Europe.
Lappa	Arctium L.	Burdock.	Root.	Europe, Northern Asia.
Matricaria . .	M. Chamomilla.	German Chamomile.	Flower-heads.	Europe.
Oleum Erigerontis . . .	Erigeron canadense.	Oil of Fleabane.	Volatile oil.	
Pyrethrum . .	Anacyclus P.	Pellitory.	Root.	Mediterranean basin.
Santonica . . .	Artemisia pauciflora.	Levant Wormseed.	Unexpanded flower-heads.	Turkestan.
Tanacetum . .	T. vulgare.		Leaves and tops.	Asia, nat.
Taraxacum . .	T. officinale.	Dandelion.	Root.	Europe, nat.
Coniferæ.				
Oleum Cadinum	Juniperus Oxycedrus.	Oleum Juniperi Empyreumaticum.	Product of dry distillation.	
Oleum Juniperi	Juniperus communis.		Volatile oil.	
Oleum Picis Liquidæ . .	Pinus palustris.		Volatile oil.	
Oleum Sabinæ.	Juniperus Sabina.		Volatile oil.	
Oleum Terebinthinæ . . .	Pinus palustris and others.		Volatile oil.	

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Euonymus.	Laxative; gr. lx.	Euonymin, asparagin, resins.	**Extract.**
Chenopodium.	Anthelmintic; gr. xx.	Volatile oil.	
Oil of Chenopodium.	Anthelmintic; ♏ v.	$C_{10}H_{16}$,—$C_{10}H_{16}O$.	
Absinthium.	Tonic; gr. xxx.	Volatile oil, absinthin, tannin, etc.	
Anthemis.	Stimulant; gr. xl.	Volatile oil, resin, etc.	
Arnica Flowers.	Vulnerary; gr. x.	Volatile oil, arnicin.	**Tincture.**
Arnica Root.	Vulnerary; gr. x.	Volatile oil, arnicin, resin.	**Extract, Fluid Extract, Tincture.**
Calendula.	Vulnerary; gr. xxx.	Trace volatile oil, calendulin, etc.	**Tincture.**
Eupatorium.	Tonic; gr. xxx.	Eupatorin, volatile oil, tannin.	**Fluid Extract.**
Grindelia.	Sedative; gr. xxx.	Volatile oil, resin.	**Fluid Extract.**
Inula.	Stimulant; gr. lx.	Helenin, inulin, acrid resin.	
Lactucarium.	Sedative; gr. iij.	Lactucin, lactucic acid, lactucerin.	**Tincture.**
Lappa.	Alterative; gr. lx.	Mucilage, inulin, tannin.	**Fluid Extract.**
Matricaria.	Stimulant; gr. xl.	Volatile oil, anthemic acid.	
Oil of Erigeron.	Stimulant; ♏ v.	$C_{10}H_{16}$.	
Pyrethrum.	Sialagogue; gr. xl.	Resin, fixed oils, inulin.	**Tincture.**
Santonica.	Anthelmintic; gr. xx.	Volatile oil, santonin, resin.	
Tansy.	Emmenagogue; gr. xl.	Volatile oil, tanacetin, resin, tannin.	
Taraxacum.	Cholagogue; gr. lx.	Inulin, pectin, taraxacin.	**Extract, Fluid Extract.**
Oil of Cade.	Parasiticide; externally.	Empyreumatic products.	
Oil of Juniper.	Stimulant; ♏ v.	$C_{10}H_{16}$.	**Spirit,** Compound Spirit of Juniper.
Oil of Tar.	Used externally.	$C_{10}H_{16}$.	
Oil of Savine.	Stimulant; ♏ ij.	$C_{10}H_{16}$.	
Oil of Turpentine.	Stimulant; ♏ x.	$C_{10}H_{16}$.	**Liniment, Rectified Oil of Turpentine,** Cantharides Cerate.

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Pix Burgundica	Abies excelsa.		Prepared resin.	Europe.
Pix Liquida .	Pinus palustris and others.		Empyreumatic oleoresin.	United States.
Resina	Pinus palustris and others.	Colophony.	Residue (from distil. turp.).	United States.
Sabina	Juniperus S.		Tops.	Europe and N. America.
Terebinthina .	Pinus palustris and others.		Concrete oleoresin.	United States.
Terebinthina Canadensis .	Abies balsamea.	Canada Balsam, Balsam of Fir.	Liquid oleoresin.	North America.
Convolvulaceæ.				
Jalapa	Ipomœa J.		Tuberous root.	Eastern Mexico.
Scammonium .	Convolvulus Scammonia.		Resinous exudation.	Western Asia.
Cruciferæ.				
Oleum Sinapis Volatile . .	Sinapis nigra.		Volatile oil.	
Sinapis Alba .	Brassica alba.		Seed.	Asia and Southern Europe.
Sinapis Nigra .	Brassica nigra.		Seed.	Asia and Southern Europe.
Cucurbitaceæ.				
Bryonia . . .	B. alba and B. dioica.	Bryony.	Root.	Central and Southern Europe.
Colocynthis . .	Citrullus C.		Fruit.	Southern and Western Asia.
Pepo	Cucurbita P.		Seed.	Asia and America.
Cupuliferæ.				
Castanea . . .	C. dentata.	Chestnut.	Leaves.	North America.
Creosotum . .	From Fagus sylvatica.			
Galla	Quercus lusitanica.		Excrescence.	Levant.
Quercus Alba .	Q. alba.		Bark.	North America.
Ericaceæ.				
Chimaphila . .	C. umbellata.	Pipsissewa.	Leaves.	Northern Continents.
Oleum Gaultheriæ	Gaultheria procumbens.	Oil of Wintergreen.	Volatile oil.	
Uva Ursi . . .	Arctostaphylos Uva-ursi.	Bearberry.	Leaves.	Northern Hemisphere.
Euphorbiaceæ.				
Cascarilla . . .	Croton Eluteria.		Bark.	Bahama Islands.
Elastica . . .	Hevea.	Caoutchouc.	Milk-juice.	South America.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Burgundy Pitch.	Irritant.	Volatile oil, resin.	**Plaster,** Iron Plaster, Opium Plaster, Cantharidal Pitch Plaster.
Tar.	Irritant; gr. xxx.	Pyroligneous acid, acetone, etc.	**Syrup, Ointment.**
Resin.	Mild stimulant.	Abietic anhydride.	**Cerate, Plaster,** Cantharides Cerate.
Savine.	Irritant; gr. v.	Volatile oil, resin, tannin.	**Fluid Extract.**
Turpentine.	Stimulant; gr. xxx.	Volatile oil, abietic anhydride.	
Canada Turpentine.	Stimulant.	Volatile oil, bitter principle.	Flexible Collodion.
Jalap.	Hydragogue cathartic; gr. xx.	Resin, starch, gum.	**Extract,** Compound Powder, **Resin.**
Scammony.	Hydragogue cathartic; gr. x.	Resin, gum.	**Resin.**
Volatile Oil of Mustard.	Rubefacient; ♏ ⅙.	Allyl sulphocyanide.	Compound Liniment of Mustard.
White Mustard.	Stimulant; gr. cxx.	Fixed oil, myrosin, sinalbin, mucilage.	
Black Mustard.	Stimulant; gr. cxx.	Fixed oil, myrosin, sinigrin, mucilage.	**Mustard Paper.**
Bryonia.	Hydragogue cathartic; gr. xx.	Bryonin.	**Tincture.**
Colocynth.	Purgative; gr. v.	Colocynth resin, pectin, etc.	**Extract.**
Pumpkin Seed.	Tænifuge; ℥i.	Fixed oil, proteids, starch.	
Castanea.	Tonic, astringent; gr. xxx.	Tannin, etc.	**Fluid Extract.**
Creosote.			**Water.**
Nutgall.	Astringent; gr. xv.	Tannin, gallic acid, mucilage, resin.	**Tincture, Ointment.**
White Oak.	Astringent; gr. xxx.	Tannin, pectin, resin.	
Chimaphila.	Astringent, diuretic; gr. xxx.	Arbutin, ericolin, tannin, chimaphilin.	**Fluid Extract.**
Oil of Gaultheria.	Flavoring; gr. v.	Methyl salicylate, $CH_3C_7H_5O_3$.	Spirit, Troches of Morphine and Ipecac, Compound Syrup of Sarsaparilla.
Uva Ursi.	Diuretic, astringent; gr. xxx.	Tannin, arbutin, gallic acid, ericolin.	**Extract, Fluid Extract.**
Cascarilla.	Tonic; gr. xx.	Volatile oil, cascarillin, resin.	
India Rubber.			Mustard Paper.

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Kamala . . .	Mallotus philippinensis.	Rottlera.	Glands and hairs.	Asia.
Oleum Ricini .	Ricinus communis.		Fixed oil.	India, United States.
Oleum Tiglii .	Croton Tiglium.		Fixed oil.	India, cult.
Stillingia . . .	S. sylvatica.	Queen's Root.	Root.	Southern United States.
Filices.				
Aspidium . . .	Dryopteris Filix-mas and D. marginalis.	Male Fern.	Rhizome.	Europe and N. America.
Fungi.				
Ergota	Claviceps purpurea, upon Secale cereale.	Ergot of Rye.	Sclerotium.	Europe and United States.
Gentianeæ.				
Chirata	Swertia C.		Entire plant.	Northern India.
Gentiana . . .	G. lutea.		Root.	C. and S. Europe.
Geraniaceæ.				
Geranium . .	G. maculatum.	Cranesbill.	Rhizome.	North America.
Gramineæ.				
Amylum . . .	Zea Mays.		Fecula of seed.	
Saccharum . .	S. officinarum.	Cane Sugar.		Tropics.
Triticum . . .	Agropyrum repens.	Couch-Grass.	Rhizome.	Europe, North America.
Zea	Z. Mays.	Corn Silk.	Styles and stigmas.	
Guttiferæ.				
Cambogia . .	Garcinia Hanburii.		Gum-resin.	Anam and Siam.
Hamamelaceæ.				
Hamamelis . .	H. virginiana.	Witchhazel.	Leaves.	North America.
Styrax	Liquidambar orientalis.		Balsam.	Asia Minor.
Hydrophyllaceæ.				
Eriodictyon . .	E. glutinosum.		Leaves.	
Irideæ.				
Crocus	C. sativus.		Stigmas.	Western Asia.
Iris	I. versicolor.	Blue Flag.	Rhizome and roots.	North America.
Juglandaceæ.				
Juglans . . .	J. cinerea.	Butternut.	Bark of root.	North America.
Labiatæ.				
Hedeoma . . .	H. pulegioides.	Pennyroyal.	Leaves and tops.	North America.
Marrubium . .	M. vulgare.	Horehound.	Leaves and tops.	Europe, nat.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Kamala.	Tænifuge; gr. lx.	Resins, rottlerin.	
Castor Oil.	Cathartic; ℥ss.	Ricinolein and palmitin.	Flexible Collodion, Compound Liniment of Mustard, Ointment of Red Mercuric Oxide, Compound Pills of Antimony.
Croton Oil.	Purge; ♏ i.	Crotonolic acid?	
Stillingia.	Alterative; gr. xx.	Resin, fixed oil, starch.	**Fluid Extract.**
Aspidium.	Tænifuge; gr. lx.	Fixed oil, filicic acid, etc.	**Oleoresin.**
Ergot.	Parturient; gr. x.	Fixed oil, sclerotic acid, scleromucin, sclererythrin.	**Fluid Extract, Wine.**
Chirata.	Tonic; gr. xx.	Ophelic acid, chiratin.	**Fluid Extract, Tincture.**
Gentian.	Tonic; gr. xx.	Gentiopicrin, gentisic acid, pectin.	**Extract, Fluid Extract, Compound Tincture.**
Geranium.	Astringent; gr. xxx.	Tannin, pectin, starch.	**Fluid Extract.**
Starch.			**Glycerite.**
Sugar.			**Syrup**, etc.
Triticum.	Diuretic; gr. c.	Glucose, triticin.	**Fluid Extract.**
Zea.			
Gamboge.	Hydragogue cathartic; gr. iv.	Gum, resin, cambogic acid.	Compound Cathartic Pills.
Hamamelis.	Astringent, hæmostatic; gr. lx.	Tannin, bitter principle.	**Fluid Extract.**
Storax.	Expectorant; gr. xv.	Styrol, cinnamic acid, storesin.	Compound Tincture of Benzoin.
Eriodictyon.			**Fluid Extract.**
Saffron.	Diaphoretic; gr. xx.	Volatile oil, proteids, etc.	**Tincture.**
Iris.	Alterative; gr. xv.	Resin, tannin, gum.	**Extract, Fluid Extract.**
Juglans.	Cathartic; gr. lx.	Nucin, fixed oil, tannin.	**Extract.**
Hedeoma.	Stimulant; gr. xxx.	Volatile oil.	
Marrubium.	Expectorant; gr. xxx.	Trace of volatile oil, marrubiin, tannin.	

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Melissa	M. officinalis.	Balm.	Leaves and tops.	Europe, nat.
Mentha Piperita	M. piperita.		Leaves and tops.	Europe and N. America.
Mentha Viridis	M. viridis.		Leaves and tops.	Europe and N. America.
Oleum Hedeomæ	Hedeoma pulegioides.	Oil of Pennyroyal.	Volatile oil.	
Oleum Lavandulæ Florum	Lavandula officinalis.		Volatile oil.	
Oleum Menthæ Piperitæ . .	Mentha piperita.		Volatile oil.	
Oleum Menthæ Viridis . . .	Mentha viridis.		Volatile oil.	
Oleum Rosmarini	Rosmarinus officinalis.		Volatile oil.	
Oleum Thymi .	Thymus vulgaris.		Volatile oil.	
Salvia	S. officinalis.	Sage.	Leaves.	Southern Europe, cult.
Scutellaria . .	S. lateriflora.	Scullcap.	Herb.	North America.
Thymol . . .	Thymus vulgaris.		Phenol.	Southern Europe, cult.
Laurineæ.				
Camphora . .	Cinnamomum C.		Stearopten.	China and Japan.
Cinnamomum Cassia . . .	Cinnamomum.		Bark of the shoots.	Ceylon and China.
Cinnamomum Saigonicum .	Cinnamomum.		Bark.	
Cinnamomum Zeylanicum .	C. zeylanicum.		Inner bark of shoots.	
Oleum Cinnamomi . . .	Cinnamomum.	Oil of Cassia.	Volatile oil.	
Oleum Sassafras	Sassafras officinalis.		Volatile oil.	
Sassafras . . .	S. variifolium.		Bark of root.	North America.
Sassafras Medulla	S. variifolium.		Pith.	North America.
Leguminosæ.				
Acacia . . } Sub-ord. Mimoseæ.	A. Senegal.	Gum Arabic.	Gummy exudation.	Africa.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Melissa.	Stimulant; gr. xxx.	Volatile oil, tannin, bitter principle.	
Peppermint.	Stimulant; gr. xxx.	Volatile oil, trace of tannin.	**Spirit.**
Spearmint.	Stimulant; gr. xxx.	Volatile oil, resin.	**Spirit.**
Oil of Hedeoma.	Stimulant; ♏ v.		
Oil of Lavender Flowers.	Scent; ♏ iij.	$C_{10}H_{16}$ and compound ethers.	**Spirit, Compound Tincture of Lavender,** Aromatic Spirit of Ammonia, Liniment of Soft Soap, Diachylon Ointment.
Oil of Peppermint.	Stimulant; ♏ iij.	$C_{10}H_{18}O$, $C_{10}H_{20}O$.	**Water, Spirit, Troches,** Compound Pills of Rhubarb, Vegetable Cathartic Pills.
Oil of Spearmint.	Stimulant; ♏ iij.	$C_{10}H_{16}$,—$C_{10}H_{14}O$.	**Water, Spirit.**
Oil of Rosemary.	Stimulant; ♏ iij.	$C_{10}H_{16}$, — $C_{10}H_{16}O$, $C_{10}H_{18}O$.	Soap Liniment, Compound Tincture of Lavender.
Oil of Thyme.	Stimulant; ♏ ij.	Cymene, $C_{10}H_{14}$, thymene, $C_{10}H_{16}$, thymol, $C_{10}H_{14}O$.	
Salvia.	Astringent; gr. xx.	Volatile oil, tannin, resin.	
Scutellaria.	Antispasmodic; gr. lx.	Bitter principle.	**Fluid Extract.**
Thymol.	Antiseptic; gr. xxx.	$C_{10}H_{14}O$.	
Camphor.	Stimulant; gr. v–x.	$C_{10}H_{16}O$.	**Water, Liniment, Spirit,** Soap Liniment, Camphorated Tincture of Opium, Belladonna Liniment, Compound Liniment of Mustard, Compound Powder of Morphine.
Cassia Cinnamon.	Stimulant; gr. xx.	Volatile oil, tannin, mannite, sugar.	Compound Tincture of Cardamom, Compound Tincture of Catechu, Compound Tincture of Lavender, Aromatic Tincture of Rhubarb, Wine of Opium.
Saigon Cinnamon.	Stimulant; gr. xx.	Volatile oil, etc.	
Ceylon Cinnamon.	Stimulant; gr. xx.	Volatile oil, etc.	**Tincture, Aromatic Powder.**
Oil of Cinnamon.	Stimulant; ♏ ij.	Cinnamic aldehyde, C_9H_8O.	**Water, Spirit,** Aromatic Sulphuric Acid.
Oil of Sassafras.	Stimulant; ♏ v.	Safrene, $C_{10}H_{16}$, safrol, $C_{10}H_{10}O_2$.	Troches of Cubeb, Compound Syrup of Sarsaparilla.
Sassafras.	Stimulant; gr. xl.	Volatile oil, tannin, sassafrid.	Compound Decoction of Sarsaparilla, Compound Fluid Extract of Sarsaparilla.
Sassafras Pith.	Demulcent.	Mucilage.	**Mucilage.**
Acacia.	Demulcent.	Gummic acid combined with calcium, magnesium, and potassium.	**Mucilage,** Emulsion of Almond, Pills of Ferrous Iodide, Pills of Phosphorus, Compound Chalk Powder, Troches of Chalk, Troches of Cubeb, Troches of Glycyrrhiza and Opium.

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Sub-ord. Mimoseæ.				
Catechu	Acacia C.		Extract from wood.	India.
Sub-ord. Cæsalpineæ.				
Cassia Fistula . . .	C. Fistula.	Purging Cassia.	Fruit.	Eastern India.
Senna . . .	Cassia acutifolia and C. angustifolia.		Leaflets.	Eastern and Central Africa.
Tamarindus	T. indica.		Preserved pulp of fruit.	India, West Indies.
Sub-ord. Papilionaceæ.				
Balsamum Peruvianum . .	Toluifera Pereiræ		Balsam.	Central America.
Balsamum Tolutanum . .	Toluifera Balsamum.		Balsam.	Venezuela.
Chrysarobinum . .	Andira Araroba.		Principle from Goa powder.	Brazil.
Copaiba . .	C. Langsdorffii.	Balsam of Copaiba.	Oleoresin.	South America.
Glycyrrhiza	G. glabra.	Liquorice Root.	Root.	Europe.
Sub-ord. Papilionaceæ.				
Hæmatoxylon . . .	H. campechianum.	Logwood.	Heart-wood.	Central America.
Kino . . .	Pterocarpus Marsupium.		Inspissated juice.	East Indies.
Oleum Copaibæ . .	Copaifera Langsdorffii.		Volatile oil.	
Physostigma . .	P. venenosum.	Calabar Bean.	Seed.	Western Africa.
Resina Copaibæ . .	Copaifera Langsdorffii.		Residue.	
Santalum Rubrum .	Pterocarpus santalinus.		Wood.	Madras, cult.
Scoparius .	Cytisus S.	Broom.	Tops.	Asia and Europe.
Tragacantha	Astragalus gummifer and others.		Gummy exudation.	Western Asia.
Lichenes.				
Cetraria . . .	C. islandica.	Iceland Moss.	Whole plant.	Northern Hemisphere.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Catechu.	Astringent; gr. xx.	Catechutannic acid, catechin.	**Troches, Compound Tincture.**
Cassia Fistula.	Laxative; gr. lx.	Sugar, pectin.	Confection of Senna.
Senna.	Cathartic; gr. lx.	Chrysophanic acid, phæoretin, cathartic acid, sennacrol, sennapicrin.	**Fluid Extract, Confection, Compound Infusion, Syrup,** Compound Powder of Glycyrrhiza.
Tamarind.	Laxative; gr. lx.	Tartaric, citric, malic, and acetic acids.	Confection of Senna.
Balsam of Peru.	Expectorant; ♏ xxx.	Cinnamein, resin, cinnamic and benzoic acids.	
Balsam of Tolu.	Expectorant; gr. xx.	Resins, cinnamic and benzoic acids.	**Syrup, Tincture,** Pills of Ferrous Iodide, Pills of Phosphorus, Compound Tincture of Benzoin.
Chrysarobin.	Irritant; gr. xx.		**Ointment.**
Copaiba.	Stimulant; ♏ xxx.	Volatile oil, resins, copaivic acid.	**Mass.**
Glycyrrhiza.	Expectorant; gr. lx.	Glycyrrhizin, asparagin, resin, sugar.	**Fluid Extract, Pure Extract, Ammoniated Glycyrrhizin, Compound Powder,** Compound Decoction of Sarsaparilla, Compound Fluid Extract of Sarsaparilla, Mass of Mercury; Pills of Ferrous Iodide, Compound Powder of Morphine, Compound Syrup of Sarsaparilla, Sweet Tincture of Rhubarb, Tincture of Aloes, Tincture of Aloes and Myrrh.
Hæmatoxylon.	Astringent; gr. xl.	Hæmatoxylin, tannin, resin.	**Extract.**
Kino.	Astringent; gr. xx.	Kinotannic acid, pyrocatechin.	**Tincture.**
Oil of Copaiba.	Stimulant; ♏ x.	$C_{15}H_{24}$.	
Physostigma.	Sedative; gr. iij.	Eserine, starch, proteids.	**Extract, Tincture.**
Resin of Copaiba.	Stimulant; gr. x.	Copaivic acid.	
Red Saunders.	Coloring; gr. lx.	Santalic acid, santal.	Compound Tincture of Lavender.
Scoparius.	Diuretic; gr. x.	Volatile oil, scoparin, sparteine.	**Fluid Extract.**
Tragacanth.	Demulcent.	Tragacanthin, starch.	**Mucilage,** Pills of Ferrous Carbonate, Troches of Tannic Acid, Troches of Ammonium Chloride, Troches of Catechu, Troches of Ipecac, Troches of Krameria, Troches of Potassium Chlorate, Troches of Santonin, Troches of Ginger, Emulsion of Chloroform.
Cetraria.	Demulcent; gr. xl.	Lichenin, cetraric acid.	**Decoction.**

NATURAL ORDER. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Liliaceæ.				
Allium	A. sativum.		Bulb.	Europe, cult.
Aloe Barbadensis	A. vera.	Curaçao Aloes.	Inspissated juice.	
Aloe Socotrina	A. Perryi.		Inspissated juice.	Africa.
Colchici Radix	C. autumnale.		Corm.	Europe.
Colchici Semen	C. autumnale.		Seed.	Europe.
Convallaria . .	C. majalis.		Rhizome and roots.	Europe.
Sarsaparilla . .	Smilax officinalis, Smilax medica, Smilax papyracea.		Root.	Tropical America.
Scilla.	Urginea maritima.		Sliced bulb.	Mediterranean basin.
Veratrum Viride	V. viride.	American Hellebore.	Rhizome and roots.	North America.
Lineæ.				
Coca	Erythroxylon C.	Erythroxylon.	Leaves.	South America.
Linum	L. usitatissimum.	Flaxseed.	Seed.	Southern Europe, cult.
Oleum Lini . .	L. usitatissimum.	Oil of Flaxseed.	Fixed oil.	Southern Europe, cult.
Lobeliaceæ.				
Lobelia. . . .	L. inflata.		Leaves and tops.	North America.
Loganiaceæ.				
Gelsemium . .	G. sempervirens.	Yellow Jasmine.	Rhizome and roots.	Southern United States.
Nux Vomica .	Strychnos Nux-vomica.		Seed.	India.
Spigelia . . .	S. marilandica.	Pinkroot.	Rhizome and roots.	United States.
Lycopodiaceæ.				
Lycopodium .	L. clavatum and others.		Spores.	Europe and N. America.
Magnoliaceæ.				
Illicium . . .	I. verum.	Star-Anise.	Fruit.	Southwestern China.
Oleum Anisi .	(See Pimpinella Anisum) Illicium verum.		Volatile oil.	
Malvaceæ.				
Althæa	A. officinalis.	Marshmallow.	Root.	Europe, nat.
Gossypii Radicis Cortex . .	G. herbaceum and others.		Bark of root.	Asia, Africa, cult.
Gossypium Purificatum . .	G. herbaceum and others.		Hairs of seed.	Tropics.
Oleum Gossypii Seminis . .	G. herbaceum and others.		Fixed oil.	

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Garlic.	Stimulant; gr. lx.	Mucilage, volatile oil.	**Syrup.**
Barbadoes Aloes.	Laxative; gr. xv.	Aloin, resin.	
Socotrine Aloes.	Laxative; gr. xv.	Aloin, resin, little volatile oil.	**Purified Aloes, Extract.**
Colchicum Root.	Sedative, emetic; gr. v.	Colchicine, starch, resin.	**Extract, Fluid Extract, Wine.**
Colchicum Seed.	Sedative; gr. v.	Colchicine, fixed oil.	**Fluid Extract, Tincture, Wine.**
Convallaria.	Cardiac sedative; gr. v–x.	Convallamarin, convallarin.	**Fluid Extract.**
Sarsaparilla.	Alterative; gr. xxx.	Parillin, resin.	**Fluid Extract, Compound Fluid Extract, Compound Decoction.**
Squill.	Expectorant.	Scillipicrin, scillitoxin, scillin, sinistrin.	**Vinegar, Fluid Extract, Tincture.**
Veratrum Viride.	Cardiac sedative; gr. ij.	Jervine, veratroidine, resin.	**Fluid Extract, Tincture.**
Coca.	Stimulant; gr. xxx.	Cocaine.	**Fluid Extract.**
Linseed.	Demulcent; gr. lx.	Fixed oil, mucilage.	
Linseed Oil.	Cathartic; f℥i.	Linolein, palmitin, myristin.	Lime Liniment, Soft Soap.
Lobelia.	Emetic; gr. x.	Lobeline.	**Fluid Extract, Tincture.**
Gelsemium.	Antispasmodic; gr. iij.	Volatile oil, gelsemine.	**Fluid Extract, Tincture.**
Nux Vomica.	Tonic; gr. ij.	Strychnine, brucine, proteids.	**Extract, Fluid Extract, Tincture.**
Spigelia.	Anthelmintic; gr. lx.	Volatile oil, bitter principle.	**Fluid Extract.**
Lycopodium.	Used externally.	Fixed oil.	
Illicium.	Stimulant; gr. xx.	Volatile oil, resin, fat.	
Oil of Anise.	Stimulant; ♏ ij.	$C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$.	Water, Spirit, Camphorated Tincture of Opium, Troches of Glycyrrhiza and Opium, Elixir of Phosphorus, Compound Spirit of Orange, Compound Syrup of Sarsaparilla.
Althæa.	Demulcent; gr. lx.	Asparagin, starch.	**Syrup,** Mass of Mercury, Pills of Ferrous Carbonate, Pills of Phosphorus.
Cotton Root Bark.	Emmenagogue; gr. lx.	Yellow resin, fixed oil, etc.	**Fluid Extract.**
Purified Cotton.		Cellulose, fixed oil.	Pyroxylin.
Cotton Seed Oil.	Demulcent; f℥ss.	Olein, palmitin.	Ammonia Liniment, Camphor Liniment.

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Menispermaceæ.				
Calumba . . .	Jateorhiza palmata.	Columbo.	Root.	Eastern Africa.
Menispermum .	M. canadense.	Yellow Parilla, Canadian Moonseed.	Rhizome and roots.	North America.
Pareira	Chondodendron tomentosum.	Pareira Brava.	Root.	Brazil.
Myristicaceæ.				
Macis	Myristica fragrans.		Arillode of seed.	Molucca Islands.
Myristica . . .	M. fragrans.		Seed.	Molucca Islands.
Oleum Myristicæ	Myristica fragrans.		Volatile oil.	
Myrtaceæ.				
Caryophyllus .	Eugenia aromatica.		Unexpanded flowers.	Molucca Islands.
Eucalyptus . .	E. globulus.		Leaves.	Australia.
Oleum Cajuputi	Melaleuca Leucadendron.		Volatile oil.	East Indian Islands.
Oleum Caryophylli . . .	Eugenia aromatica.		Volatile oil.	
Oleum Eucalypti	Eucalyptus globulus, E. oleosa, and others.		Volatile oil.	
Oleum Myrciæ	Myrcia acris.	Oil of Bay.	Volatile oil.	
Oleum Pimentæ	Pimenta officinalis.	Oil of Allspice.	Volatile oil.	
Pimenta . . .	P. officinalis.	Allspice.	Nearly ripe fruit.	Tropical America.
Oleaceæ.				
Manna	Fraxinus Ornus.		Conc. sacch. exudation.	Mediterranean basin.
Oleum Olivæ .	Olea europæa.		Fixed oil.	Southern Europe.
Orchideæ.				
Cypripedium .	C. pubescens and C. parviflorum.	Ladies' Slipper.	Rhizome and root.	North America.
Vanilla	V. planifolia.		Fruit.	Eastern Mexico.
Papaveraceæ.				
Chelidonium .	C. majus.	Celandine.	Whole plant.	Europe, North America.
Opii Pulvis . .			Powder.	

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Calumba.	Tonic; gr. xx.	Columbin, berberine.	**Fluid Extract, Tincture.**
Menispermum.	Alterative; gr. xxx.	Berberine, menispine.	**Fluid Extract.**
Pareira.	Diuretic; gr. xl.	Pelosine.	**Fluid Extract.**
Mace.	Stimulant; gr. xv.	Volatile oil, resin.	
Nutmeg.	Stimulant; gr. xv.	Volatile oil, fixed oil, proteids.	Vinegar of Opium, Aromatic Powder, Compound Tincture of Lavender, Aromatic Tincture of Rhubarb, Troches of Sodium Bicarbonate.
Oil of Nutmeg.	Stimulant; ♏ ij.	Myristicine, $C_{10}H_{16}$, and myristicol, $C_{10}H_{14}O$.	**Spirit**, Aromatic Spirit of Ammonia.
Cloves.	Stimulant; gr. x.	Volatile oil, tannin, resin.	Compound Tincture of Lavender, Aromatic Tincture of Rhubarb, Wine of Opium.
Eucalyptus.	Febrifuge; gr. xx.	Volatile oil, tannin, resin.	**Fluid Extract.**
Oil of Cajuput.	Diaphoretic; ♏ v.	Cajuputol, $C_{10}H_{18}O$.	
Oil of Cloves.	Stimulant; ♏ iv.	$C_{10}H_{16}$, and eugenol, $C_{10}H_{12}O_2$.	
Oil of Eucalyptus.	Febrifuge; ♏ x.	$C_{10}H_{14}$, $C_{10}H_{16}$, $C_{10}H_{18}O$.	
Oil of Myrcia.	Stimulant.	$C_{10}H_{16}$ and $C_{10}H_{12}O_2$.	**Spirit.**
Oil of Pimenta.	Stimulant; ♏ iv.	$C_{10}H_{16}$ and $C_{10}H_{12}O_2$.	Spirit of Myrcia.
Pimenta.	Stimulant; gr. xx.	Volatile oil, tannin, resin.	
Manna.	Laxative; ℥i.	Mannite, fraxin, resin, glucose.	Compound Infusion of Senna.
Olive Oil.	Laxative; f℥i.	Olein, palmitin, arachin, stearin.	Spermaceti Cerate, Lead Plaster, Diachylon Ointment, Iron Plaster, Burgundy Pitch Plaster, Veratrine Ointment.
Cypripedium.	Diaphoretic; gr. xv.	Volatile oil, tannin, resins.	**Fluid Extract.**
Vanilla.	Stimulant; gr. xx.	Vanillin, fixed oil, resin, sugar.	Tincture, Troches of Iron.
Chelidonium.	Diuretic; gr. xl.	Chelidonine, chelerythrine.	
Powdered Opium.	Narcotic; gr. i.	Morphine, narcotine, codeine, etc.	**Vinegar, Extract, Pills, Tincture, Wine,** Camphorated Tincture, Powder of Ipecac and Opium, Troches of Glycyrrhiza and Opium, Deodorized Opium, Tincture of Deodorized Opium.

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Opium	Papaver somniferum.		Concrete milky exud.	Western Asia, cult.
Sanguinaria . .	S. canadensis.	Bloodroot.	Rhizome.	North America.
Pedaliaceæ.				
Oleum Sesami .	Sesamum indicum.	Sesame Oil, Teel Oil, Benne Oil.	Fixed oil.	India.
Phytolaccaceæ.				
Phytolaccæ Fructus . .	P. decandra.	Poke Berry.	Fruit.	North America.
Phytolaccæ Radix . . .	P. decandra.	Poke Root.	Root.	North America.
Piperaceæ.				
Cubeba	Piper C.		Unripe fruit.	Java, cult.
Matico	Piper angustifolium.		Leaves.	Tropical America.
Oleum Cubebæ	Piper Cubeba.		Volatile oil.	
Piper	P. nigrum.	Black Pepper.	Unripe fruit.	India, cult.
Polygaleæ.				
Krameria (Sub-ord. Kramerieæ.)	K. triandra and Ixina.		Root.	South America.
Senega . . (Sub-ord. Kramerieæ.)	Polygala S.		Root.	United States.
Polygonaceæ.				
Rheum	R. officinale.		Root.	Western and Central China.
Rumex	R. crispus and others.	Yellow Dock.	Root.	Europe, nat.
Ranunculaceæ.				
Aconitum . .	A. Napellus.		Tuber.	Europe, Asia.
Cimicifuga . .	C. racemosa.	Black Snakeroot.	Rhizome and roots.	North America.
Hydrastis . . .	H. canadensis.	Golden Seal.	Rhizome and roots.	North America.
Pulsatilla . . .	Anemone P., A. pratensis.		Herb.	Europe.
Staphisagria . .	Delphinium S.	Stavesacre.	Seed.	Europe.
Rhamnaceæ.				
Frangula . . .	Rhamnus F.	Buckthorn.	Bark.	Western Asia, cult.
Rhamnus Purshiana .	Rhamnus Purshiana.		Bark.	Western Asia, cult.
Rosaceæ.				
Amygdala Amara . . .	Prunus Amygdalus, var. amara.		Seed.	Western Asia, cult.
Amygdala Dulcis	Prunus Amygdalus, var. dulcis.		Seed.	Western Asia, cult.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Opium.	Narcotic; gr. i.	Morphine, narcotine, codeine.	**Powder.**
Sanguinaria.	Alterative; gr. x.	Sanguinarine, resins, starch.	**Fluid Extract, Tincture.**
Oil of Sesamum.	Demulcent; f℥i.	Olein, myristin, palmitin, stearin.	
Phytolacca Fruit.	Laxative; gr. xx.	Sugar, gum.	
Phytolacca Root.	Alterative; gr. xx.	Resin, tanrin.	**Fluid Extract.**
Cubeb.	Stimulant; gr. xx.	Volatile oil, resin, cubebin.	**Fluid Extract, Oleoresin, Tincture.**
Matico.	Stimulant; gr. lx.	Volatile oil, artanthic acid.	**Fluid Extract, Tincture.**
Oil of Cubeb.	Stimulant; ♏ x.	$C_{10}H_{16} — C_{15}H_{24}$.	
Pepper.	Stimulant; gr. x.	Volatile oil, resin, piperine, fat.	**Oleoresin.**
Krameria.	Astringent; gr. xx.	Kramero-tannic acid, rhatanic red.	**Extract, Fluid Extract, Tincture.**
Senega.	Expectorant; gr. xv.	Polygalic acid, pectin, fixed oil.	**Fluid Extract.**
Rhubarb.	Purgative, astringent; gr. x.	Chrysophan, erythroretin, emodin, phæoretin, tannin.	**Extract, Fluid Extract, Pills, Compound Pills, Compound Powder, Tincture, Aromatic Tincture, Sweet Tincture.**
Rumex.	Alterative; gr. lx.	Tannin, chrysophanic acid.	**Fluid Extract.**
Aconite.	Sedative; gr. i.	Resin, aconitic acid, aconitine.	**Extract, Fluid Extract, Tincture.**
Cimicifuga.	Alterative; gr. xxx.	Crystalline principle, resin, tannin.	**Extract, Fluid Extract, Tincture.**
Hydrastis.	Alterative, tonic; gr. xl.	Berberine, hydrastine, xanthopucine.	**Fluid Extract, Tincture, Glycerite.**
Pulsatilla.	Irritant, diaphoretic; gr. iv.	Oily substance, anemonic acid.	
Staphisagria.	Used externally.	Delphinine, fixed oil.	
Frangula.	Laxative; gr. xx.	Frangulin, tannin, emodin.	**Fluid Extract.**
Rhamnus Purshiana.	Laxative; gr. xx.	Purgative resins, chrysophanic acid.	**Fluid Extract.**
Bitter Almond.	Demulcent.	Fixed oil, proteids, amygdalin.	**Syrup.**
Sweet Almond.	Demulcent.	Fixed oil, proteids.	**Emulsion, Syrup.**

Natural Order. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Oleum Amygdalæ Amaræ	Prunus Amygdalus, var. amara.		Volatile oil.	
Oleum Amygdalæ Expressum	Prunus Amygdalus, var. dulcis, Prunus A., var. amara.		Fixed oil.	
Prunum . . .	Prunus domestica.		Fruit.	Western Asia, cult.
Prunus Virginiana	P. serotina.		Bark.	North America.
Sub-ord. Dryadeæ.				
Rubus . .	R. canadensis, R. villosus, R. trivialis.	Blackberry.	Bark of root.	North America.
Rubus Idæus .	R. idæus.		Fruit.	Europe and Asia, cult.
Sub-ord. Pomeæ.				
Cusso . .	Hagenia abyssinica.		Female inflorescence.	Abyssinia.
Sub-ord. Roseæ.				
Oleum Rosæ	Rosa damascena.		Volatile oil.	Roumelia.
Quillaja . .	Q. Saponaria.	Soap Bark.	Bark.	Chili and Peru.
Rosa Centifolia . .	R. centifolia.		Petals.	Western Asia, cult.
Rosa Gallica	R. gallica.		Petals.	Southern Europe, cult.
Rubiaceæ.				
Sub-ord. Cinchonæ.				
Cinchona .	Cinchonas with 5 per cent. of alkaloids.		Bark.	South America.
Cinchona Rubra .	C. succirubra.		Bark.	South America.
Ipecacuanha .	Cephaëlis I.		Root.	Brazil.
Rutaceæ.				
Aurantii Amari Cortex . . .	Citrus vulgaris.		Rind of fruit.	Northern India, and cult.
Aurantii Dulcis Cortex . . .	Citrus Aurantium.		Rind of fresh fruit.	Northern India, and cult.
Oleum Aurantii Cortex . . .	Citrus vulgaris, C. Aurantium.		Volatile oil.	
Oleum Aurantii Florum . .	Citrus vulgaris.	Oil of Neroli.	Volatile oil.	
Limonis Cortex	Citrus Limonum.		Rind of recent fruit.	Northern India, and cult.
Limonis Succus	Citrus Limonum.		Juice.	Northern India, and cult.
Oleum Bergamottæ . . .	Citrus Bergamia.	Oleum Bergamii.	Volatile oil.	
Oleum Limonis	Citrus Limonum.		Volatile oil.	
Buchu	Barosma betulina and B. crenulata.		Leaves.	Southern Africa.
Pilocarpus . .	P. Selloanus and P. Jaborandi.	Jaborandi.	Leaflets.	Brazil.
Xanthoxylum .	X. americanum and X. Clava-Herculis.	Prickly Ash.	Bark.	North America.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Oil of Bitter Almond.	Sedative; ♏ i.	Benzaldehyde, C_7H_6O.	**Water, Spirit.**
Expressed Oil of Almond.	Laxative.	Olein, palmitin.	Ointment of Rose Water, Phosphorated Oil, Emulsion of Chloroform.
Prune.	Laxative.	Sugar, pectin, malic acid.	Confection of Senna.
Wild Cherry.	Sedative; gr. xl.	Tannin, amygdalin, emulsin.	**Fluid Extract, Infusion, Syrup.**
Rubus.	Astringent; gr. xx.	Tannin.	**Fluid Extract.**
Raspberry.	Refrigerant.	Volatile oil, pectin, glucose.	**Syrup.**
Kousso.	Anthelmintic; gr. lx.	Tannin, acrid resin, kosin.	**Fluid Extract.**
Oil of Rose.	Scent.	Elæopten, stearopten.	
Quillaja.	Irritant; gr. xv.	Saponin.	**Tincture.**
Pale Rose.	Astringent; gr. x.	Volatile oil, tannin.	
Red Rose.	Tonic; gr. xx.	Volatile oil, quercitrin.	**Fluid Extract, Confection,** Pills of Aloes and Mastic.
Cinchona.	Tonic; gr. xx.	Quinine, quinidine, cinchonine, cinchonidine, etc.	**Extract, Fluid Extract, Infusion, Tincture.**
Red Cinchona.	Tonic, antiperiodic; gr. xx.	Vide Cinchona.	Compound Tincture of Cinchona.
Ipecac.	Expectorant; gr. v.	Emetine, ipecacuanhic acid, pectin.	**Fluid Extract, Troches,** Powder of Ipecac and Opium, Troches of Morphine and Ipecac.
Bitter Orange Peel.	Stimulant, tonic; gr. xl.	Volatile oil, hesperidin, etc.	**Fluid Extract, Tincture.**
Sweet Orange Peel.	Stimulant.	Volatile oil, hesperidin, etc.	**Syrup, Tincture.**
Oil of Orange Peel.	Flavoring.	$C_{10}H_{16}$.	**Spirit, Compound Spirit,** Spirit of Myrcia.
Oil of Orange Flowers.	Flavoring.	$C_{10}H_{16}$.	
Lemon Peel.	Flavoring.	Volatile oil, hesperidin.	**Spirit.**
Lemon Juice.	Refrigerant.	Citric acid, water, etc.	
Oil of Bergamot.			
Oil of Lemon.			**Spirit, Compound Spirit.**
Buchu.	Diuretic; gr. xx.	Volatile oil, diosphenol, resin, mucilage, rutin.	**Fluid Extract.**
Pilocarpus.	Sialagogue; gr. xx.	Volatile oil, pilocarpine.	**Fluid Extract.**
Xanthoxylum.	Alterative; gr. xv.	Acrid green oil, resin.	**Fluid Extract.**

NATURAL ORDER. Official Name.	Botanical Name.	Synonyms.	Part used, or Description.	Habitat.
Santalaceæ.				
Oleum Santali .	Santalum album.	Oil of Sandal Wood.	Volatile oil.	
Sapindaceæ.				
Guarana . . .	Paullinia Cupana and P. sorbilis.		Dried paste from seeds.	Northern and Western Brazil.
Scitamineæ.				
Cardamomum .	Elettaria repens.		Fruit.	Malabar, cult.
Zingiber . . .	Z. officinale.		Rhizome.	West Indies, India.
Scrophularineæ.				
Digitalis . . .	D. purpurea.	Foxglove.	Leaves.	Europe.
Leptandra . .	Veronica virginica.	Culver's Root.	Rhizome and root.	North America.
Simarubeæ.				
Quassia	Picræna excelsa.		Wood.	Jamaica.
Solanaceæ.				
Belladonnæ Folia	Atropa B.		Leaves.	Central and Southern Europe.
Belladonnæ Radix	Atropa B.		Root.	Central and Southern Europe.
Capsicum . . .	C. fastigiatum.	Cayenne Pepper, African Pepper.	Fruit.	Tropical America.
Dulcamara . .	Solanum D.	Bitter-sweet.	Young branches.	Europe, nat.
Hyoscyamus .	H. niger.	Henbane.	Leaves and flowering tops.	Europe and Asia.
Stramonii Folia	Datura Stramonium.		Leaves.	Asia, nat.
Stramonii Semen	Datura Stramonium.		Seeds.	Asia, nat.
Tabacum . . .	Nicotiana T.		Commercial dried leaves.	America.
Sterculiaceæ.				
Oleum Theobromatis . .	Theobroma Cacao.	Butter of Cacao.	Fixed oil.	South America.
Styraceæ.				
Benzoinum . .	Styrax Benzoin.		Balsamic resin.	Sumatra.
Thymelaceæ.				
Mezereum . .	Daphne M., and others.		Bark.	Europe.
Umbelliferæ.				
Conium } Sub-ord. Campylospermæ.	C. maculatum.	Hemlock.	Full-grown fruit.	Europe, nat.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Oil of Santal.	Stimulant; ♏ x.	$C_{15}H_{24}O—C_{15}H_{26}O$.	
Guarana.	Stimulant; gr. lx.	Caffeine, saponin.	**Fluid Extract.**
Cardamom.	Stimulant; gr. x.	Volatile oil, fixed oil.	Aromatic Powder, **Tincture, Compound Tincture**, Sweet Tincture of Rhubarb, Tincture of Rhubarb, Compound Tincture of Gentian, Compound Extract of Colocynth.
Ginger.	Stimulant; gr. xv.	Volatile oil, gingerol, resin.	**Fluid Extract, Oleoresin,** Aromatic Powder, **Tincture,** Compound Powder of Rhubarb.
Digitalis.	Cardiac stimulant; gr. ij.	Digitalin, resin, pectin.	**Extract, Fluid Extract, Infusion, Tincture.**
Leptandra.	Alterative; gr. xxx.	Leptandrin, resin, saponin, tannin.	**Extract, Fluid Extract.**
Quassia.	Tonic; gr. xx.	Mucilage, resin, quassin.	**Extract, Fluid Extract, Tincture.**
Belladonna Leaves.	Sedative; gr. ij.	Atropine, hyoscyamine, belladonnine.	**Alcoholic Extract, Tincture.**
Belladonna Root.	Sedative; gr. i.	Atropine, hyoscyamine, belladonnine.	**Fluid Extract.**
Capsicum.	Stimulant; gr. v.	Capsaicin, fixed oil.	**Fluid Extract, Oleoresin, Tincture.**
Dulcamara.	Alterative; gr. xxx.	Resin, dulcamarin.	**Fluid Extract.**
Hyoscyamus.	Narcotic; gr. v.	Hyoscyamine, hyoscine.	**Extract, Fluid Extract, Tincture.**
Stramonium Leaves.	Narcotic; gr. iij.	Daturine, mucilage.	
Stramonium Seeds.	Narcotic; gr. ij.	Daturine, fixed oil.	**Extract, Fluid Extract, Tincture.**
Tobacco.	Emetic; gr. v.	Nicotine, resin, gum.	
Oil of Theobroma.	Emollient.	Stearin, palmitin, olein.	**Suppositories.**
Benzoin.	Stimulant; gr. xxx.	Benzoic acid, cinnamic acid.	**Benzoinated Lard, Tincture, Compound Tincture.**
Mezereum.	Sialagogue, stimulant; gr. v.	Soft acrid resin, daphnin.	**Fluid Extract,** Compound Decoction of Sarsaparilla, **Compound Fluid Extract of Sarsaparilla.**
Conium.	Sedative; gr. v.	Fixed oil, coniine.	**Extract, Fluid Extract.**

Natural Order. Official Name.		Botanical Name.	Synonyme.	Part used, or Description.	Habitat.
Coriandrum	Sub-ord. Cœlospermæ.	C. sativum.		Fruit.	Europe, cult.
Oleum Coriandri	Sub-ord. Cœlospermæ.	Coriandrum sativum.		Volatile oil.	
Ammoniacum	Sub-ord. Orthospermæ.	Dorema A.		Gum-resin.	Eastern Persia.
Anisum	Sub-ord. Orthospermæ.	Pimpinella A. (see Illicium verum).		Fruit.	Asia, cult.
Asafœtida	Sub-ord. Orthospermæ.	Ferula fœtida.		Gum-resin.	Persia.
Carum	Sub-ord. Orthospermæ.	C. Carvi.		Fruit.	Central and W. Asia, cult.
Fœniculum	Sub-ord. Orthospermæ.	F. capillaceum.		Fruit.	Southern Europe, cult.
Oleum Anisi	Sub-ord. Orthospermæ.	Pimpinella Anisum.		Volatile oil.	
Oleum Cari	Sub-ord. Orthospermæ.	Carum Carvi.		Volatile oil.	
Oleum Fœniculi	Sub-ord. Orthospermæ.	Fœniculum capillaceum.		Volatile oil.	
Sumbul	Sub-ord. Orthospermæ.	Ferula S.		Root.	Asia.
Urticaceæ.					
Ficus	Sub-ord. Artocarpeæ.	F. Carica.		Fleshy receptacle.	Western Asia, cult.
Cannabis Indica	Sub-ord. Cannabineæ.	C. sativa.	Indian Hemp.	Flowering tops of female plant.	Asia.
Humulus	Sub-ord. Cannabineæ.	H. Lupulus.		Strobiles.	Europe and Asia.
Lupulinum	Sub-ord. Cannabineæ.	H. Lupulus.		Glandular powder from strobiles.	Europe and Asia.
Ulmus	Sub-ord. Ulmeæ.	U. fulva.	Slippery Elm.	Inner bark.	North America.
Valerianaceæ.					
Valeriana		V. officinalis.		Rhizome and root.	Europe, nat.
Vitaceæ.					
Vinum Album		Vitis vinifera.		Fermented juice of grapes.	
Vinum Rubrum		Vitis vinifera.		Fermented juice of grapes.	
Zygophylleæ.					
Guaiaci Lignum		G. officinale and G. sanctum.		Heart-wood.	West Indies and South America.
Guaiaci Resina		G. officinale.		Resin of wood.	West Indies and South America.

English Name.	Medical Properties, Dose.	Constituents.	Official Preparations in heavy type; those into which the Drug enters, in Roman type.
Coriander.	Stimulant; gr. xx.	Volatile oil, fat, mucilage.	
Oil of Coriander.	Stimulant; ♏ iij.	$C_{10}H_{18}O$.	Syrup of Senna, Compound Spirit of Orange, Confection of Senna.
Ammoniac.	Stimulant; gr. xv.	Volatile oil, resin, gum.	**Emulsion**, Ammoniac Plaster with Mercury.
Anise.	Stimulant; gr. xx.	Volatile oil, fixed oil, sugar.	Sweet Tincture of Rhubarb.
Asafetida.	Nervine; gr. x.	Volatile oil, gum-resin.	**Emulsion, Pills, Tincture,** Pills of Aloes and Asafetida.
Caraway.	Stimulant; gr. xx.	Volatile oil, resin, little tannin.	Compound Tincture of Cardamom.
Fennel.	Stimulant; gr. xx.	Volatile and fixed oil, sugar.	Compound Infusion of Senna.
Oil of Anise.	Stimulant; ♏ iij.	$C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$.	**Water, Spirit,** Compound Spirit of Orange, Camphorated Tincture of Opium, Troches of Glycyrrhiza and Opium, Elixir of Phosphorus, Compound Syrup of Sarsaparilla.
Oil of Caraway.	Stimulant; ♏ v.	Carvine, $C_{10}H_{16}$, and carvol, $C_{10}H_{14}O$.	Compound Spirit of Juniper.
Oil of Fennel.	Stimulant; gr. x.	$C_{10}H_{16}$, and anethol, $C_{10}H_{12}O$.	**Water,** Compound Spirit of Juniper, Compound Powder of Glycyrrhiza.
Sumbul.	Stimulant; gr. x.	Volatile oil, resin, valerianic acid.	**Tincture.**
Fig.	Laxative.	Cellular tissue, sugar, gum, fat, etc.	Confection of Senna.
Indian Cannabis.	Nervine; gr. v.	Resin, cannabinine.	**Extract, Fluid Extract, Tincture.**
Hops.	Tonic; gr. xl.	Volatile oil, resin, tannin.	**Tincture.**
Lupulin.	Tonic; gr. v.	Volatile oil, lupuline, resin.	**Fluid Extract, Oleoresin.**
Elm.	Demulcent.	Mucilage.	**Mucilage.**
Valerian.	Nervine; gr. xxx.	Valerianic, formic, and acetic acids.	**Fluid Extract, Tincture, Ammoniated Tincture.**
White Wine.	Stimulant.	Alcohol, bouquet, etc.	**Vina.**
Red Wine.	Stimulant.	Alcohol, bouquet, etc.	**Vina.**
Guaiacum Wood.	Anti-rheumatic, diaphoretic; gr. lx.	Resin, extractive.	Compound Decoction of Sarsaparilla.
Guaiac.	Anti-rheumatic, gr. xv.	Guaiacic acid, Guaiac yellow.	**Tincture, Ammoniated Tincture,** Compound Pills of Antimony.

CHAPTER LXI.

PRODUCTS FROM ANIMAL SUBSTANCES.

THE animal products of pharmaceutical interest are not numerous, but some of them are very important. Their chemical composition is not very well understood.

Protein compounds are universally found in animal and vegetable substances,—indeed, are essential to all living organisms. In their chemical composition nitrogen is always a constituent, together with carbon, hydrogen, and oxygen, and often a small quantity of sulphur. Very little is definitely known of the exact composition of the protein compounds: they are usually colloids and uncrystallizable, varying in their solubilities in aqueous liquids; they are generally coagulated by heat, and on exposure to air, heat, and moisture they decompose, undergoing *putrefaction*. If warmed to 70° C. (158° F.) in contact with *Millon's reagent*, they yield a purple-red color: this reagent is made by dissolving ten grammes of mercury in twenty grammes of nitric acid (sp. gr. 1.42), diluting the solution with an equal volume of water, and decanting after allowing it to stand twenty-four hours.

The animal products of interest in pharmacy are grouped according to the *class* to which they belong, as follows: 1. Mammalia. 2. Pisces. 3. Aves. 4. Insecta. 5. Reptilia. 6. Annelida. There are no official products from the last two classes.

Official Products derived from the Class Mammalia.

ADEPS. *U.S.* Lard.

The prepared internal fat of the abdomen of *Sus Scrofa* Linné (class *Mammalia;* order *Pachydermata*), purified by washing with water, melting, and straining. Lard should be kept in well-closed vessels impervious to fat, and in a cool place.

Preparation.—The adipose matter adhering to the kidneys, mesentery, and omentum of the hog is the usual source of the best lard. This, after careful removal of the membranes and adhering flesh, should be cut into small pieces, malaxated with successive portions of cold water until this remains clear, and then heated *moderately*, in a tinned, iron, or copper vessel, over a *slow* fire, until the melted fat becomes perfectly clear and anhydrous. Lastly, it is to be strained into earthen pots, being occasionally stirred as it cools; and the pots should be securely covered with waxed or varnished paper, and kept in a cool, dry cellar.

The purification of lard, by which the "odor of the pig" is separated, is attended with considerable labor. In France this is an industry by itself, large quantities of purified lard being used in making pomades

(see page 855). The process usually consists in spreading the lard, which has been heated with a little powdered alum, strained, and cooled, upon an inclined slate or marble slab so arranged that a stream of water can trickle on it. Whilst the water is running, the lard is thoroughly worked with a spatula, stirrer, or muller, so that a fresh surface is continually exposed to the action of the water. This tedious process is continued until the lard is *completely washed and deodorized.*

Adeps. *U.S.*	Odor, Taste, and Reaction.	Solubility.
A soft, white, unctuous solid. It melts at 38° to 40° C. (100.4° to 104° F.) to a clear liquid, which is colorless in thin layers, and which should not separate an aqueous layer, and at or below 30° C. (86° F.) it is a soft solid. Sp. gr. about 0.932 at 15° C. (59° F.).	Faint odor, free from rancidity; bland taste; neutral reaction.	Entirely soluble in ether, benzin, chloroform, and carbon disulphide; insoluble in water; very slightly soluble in alcohol.

Impurities.	Tests for Impurities.
Alkalies.	Distilled water, boiled with Lard, should not acquire an alkaline reaction.
Starch.	Distilled water, boiled with Lard, should not be colored blue by iodine T.S.
Chlorides.	A portion of distilled water, boiled with Lard, when filtered, acidulated with nitric acid, and treated with silver nitrate T.S., should not yield a white precipitate soluble in ammonia.
Free Fatty Acids.	If 10 Gm. of Lard be dissolved in chloroform, and the solution mixed with 10 C.c. of alcohol and 1 drop of phenolphtalein T.S., it should not require more than 0.2 C.c. of normal potassium hydrate V.S. to produce a pink tint after strong shaking.
More than 5 per cent. of Cotton Seed Fats.	If 5 C.c. of melted and filtered Lard be, while warm, intimately mixed by agitation, in a test-tube, with 5 C.c. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 C.c. of deodorized alcohol and adding 2 drops of nitric acid), and the mixture then heated for five minutes in a water-bath, the liquid fat should not acquire a reddish or brown color, nor should any dark color be produced at the line of contact of the two liquids.

Lard, like most animal fats and oils, consists of stearin, palmitin, and olein, its consistence, when pure, depending largely upon the relative proportion of these principles: olein, being the liquid principle, can readily be separated from the other two, by subjecting lard in cold weather to strong pressure, when the *olein* (*lard oil*) is pressed out, the solid residue (*stearin*) being used for various purposes, particularly for the manufacture of candles. Lard is used in pharmacy principally as a base for ointments: it needs protection from rancidity, however. (See Adeps Benzoinatus.)

ADEPS BENZOINATUS. *U.S.* Benzoinated Lard.

	Metric.	Old form.
Lard	1000 Gm.	16 oz. av.
Benzoin, in coarse powder	20 Gm.	140 grains.

Melt the Lard by means of a water-bath. Tie the Benzoin loosely

in a piece of coarse muslin, suspend it in the melted Lard, and, stirring frequently, continue the heat for two hours, covering the vessel and not allowing the temperature to rise above 60° C. (140° F.). Lastly, having removed the Benzoin, strain the Lard, and stir occasionally while it cools.

When Benzoinated Lard is to be kept or used during warm weather, 5 per cent. (or more, if necessary) of the Lard should be replaced by White Wax.

Certain balsamic substances, when digested with lard or fats, have the property of preventing or retarding rancidity: benzoin is most frequently used for this purpose. The temperature at which it is digested should not exceed 60° C. (140° F.), or the agreeable vanilla-like odor of the benzoin will be dissipated. The method of adding tincture of benzoin to cold lard does not produce as good a product, for it is darker in color, less fragrant, and sometimes acts as an irritant when applied in certain skin diseases.

OLEUM ADIPIS. *U.S.* Lard Oil.

A fixed oil expressed from Lard at a low temperature.

Preparation.—This oil, which consists principally of olein, is made by exposing lard to a low temperature and then pressing it powerfully in a hydraulic press.

As found in commerce, it is almost *invariably adulterated with paraffin oil.* As it is largely employed as a lubricating oil, this admixture is not particularly injurious, but for its principal use in pharmacy, as the base of citrine ointment, the presence of the paraffin oil prevents solidification.

Oleum Adipis. *U.S.*	Impurities.	Tests for Impurities.
A colorless or pale yellow, oily liquid, having a peculiar odor and bland taste. Sp. gr. 0.910 to 0.920 at 15° C. (59° F.). At a temperature a little below 10° C. (50° F.) it usually commences to deposit a white, granular fat, and at or near 0° C. (32° F.) it forms a semi-solid, white mass. When it is brought in contact with concentrated sulphuric acid, a dark, reddish-brown color is instantly produced.	More than about 5 per cent. of Cotton Seed Oil.	If 5 C.c. of the Oil be thoroughly shaken, in a test-tube, with 5 C.c. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 C.c. of deodorized alcohol, and adding 2 drops of nitric acid), and the mixture heated for about five minutes in a water-bath, the Oil should remain nearly or quite colorless, not acquiring a reddish or brown color, nor should any dark color be produced at the line of contact of the two liquids.
	Appreciable Quantities of Paraffin Oils.	If 5 C.c. of the Oil, contained in a small flask, be mixed with a solution of 2 Gm. of potassium hydrate in 2 C.c. of water, then 5 C.c. of alcohol added, and the mixture heated for about five minutes on a water-bath, with occasional agitation, a perfectly clear and complete solution should be formed, which, on dilution with water to the volume of 50 C.c., should form a transparent, light yellow liquid, without the separation of an oily layer.

ADEPS LANÆ HYDROSUS. *U.S.* Hydrous Wool-Fat.

The purified fat of the wool of sheep (*Ovis Aries* Linné; class *Mammalia; order Ruminantia*), mixed with not more than 30 per cent. of water.

This substance, to which the name of *lanoline* is commonly applied, is made by a patented process, which consists essentially of purifying the fatty matter obtained from the wool of the sheep (*suint*), by repeated treatment with water, in a centrifugal machine. *Wool-fat* differs from *hydrous wool-fat* in containing no water.

Adeps Lanæ Hydrosus. *U. S.*	Odor.	Solubility.
A yellowish-white or nearly white, ointment-like mass. It melts at about 40° C. (104° F.).	Faint, peculiar odor.	Insoluble in water, but miscible with twice its weight of the latter, without losing its ointment-like character. With ether or chloroform it yields turbid, neutral solutions.

Tests for Identity.	Impurities.	Tests for Impurities.
Hydrous Wool-Fat melts at about 40° C. (104° F.). When heated on a water-bath, it finally leaves a residue amounting to not less than 70 per cent., which is transparent while melted, and, when cold, appears as a yellow, tough, unctuous mass, completely soluble in ether or chloroform, and only partially soluble in alcohol. A solution (1 in 50) of a portion of this mass in chloroform, when poured on the surface of concentrated sulphuric acid, gradually develops a deep brown color at the line of contact of the two layers.	Alkalies.	When a portion is ignited, it should not leave more than 0.3 per cent. of ash, which should not have an alkaline reaction. If 2 Gm. of the same mass be dissolved in 10 C.c. of ether and mixed with 2 drops of phenolphtalein T.S., a colorless liquid results.
	Free Fatty Acids.	The above colorless liquid should be decidedly reddened by 1 drop of normal potassium hydrate V.S.
	Fats and Ammonia.	If 10 Gm. of Hydrous Wool-Fat be heated, together with 50 C.c. of water, on a water-bath, until the fat is melted, there should result an upper, translucent and light yellow, fatty layer, and a lower, clear, aqueous layer, which latter should not yield glycerin upon evaporation, and, when a portion of it is heated with some potassium or sodium hydrate T.S., it should not emit vapors of ammonia.

Uses.—This substance is used largely as a basis for ointments, for which it is admirably adapted.

SEVUM. *U. S.* Suet. [Mutton Suet.]

The internal fat of the abdomen of *Ovis Aries* Linné (class *Mammalia*; order *Ruminantia*), purified by melting and straining.

Suet should be kept in well-closed vessels impervious to fat. It should not be used after it has become rancid.

Preparation.—Suet is made by a process similar to that for lard. (See Adeps.)

Sevum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A white, smooth, solid fat.	Nearly inodorous, gradually becoming rancid on exposure to air; bland taste; neutral reaction.	Boiling, 44 parts.	About 60 parts of ether, 2 parts of benzin, and insoluble in water.

Test for Identity.
From its solution in benzin, kept in a stoppered flask, it slowly separates in a crystalline form on standing. It melts between 45° and 50° C. (113° and 122° F.), and congeals between 37° and 40° C. (98.6° and 104° F.).

Uses.—Suet is firmer than lard, owing to its containing a larger proportion of stearin. It is used in making mercurial ointment.

PEPSINUM. *U. S.* Pepsin.

A proteolytic ferment or enzyme obtained from the glandular layer of fresh stomachs from healthy pigs, and capable of digesting not less than 3000 times its own weight of freshly coagulated and disintegrated egg albumen, when tested by the process given below.

If it be desired to use a diluent for reducing Pepsin of a higher digestive power to that required by the Pharmacopœia, Sugar of Milk should be employed for this purpose.

Preparation.—Pepsin is largely made by the following process of Prof. Scheffer. The mucous membrane of hogs' stomachs is macerated in water acidulated with hydrochloric acid for several days, with frequent stirring. The strained liquid, if not clear, is clarified by allowing it to stand for twenty-four hours, and decanting. Sodium chloride is then thoroughly mixed with it. After several hours the floating pepsin is skimmed from the surface and put on a cotton cloth to drain, and finally is submitted to strong pressure to get rid of the saline solution. This pepsin, when air-dried, is very tough, parchment-like or leathery, varying in color from a dim straw-yellow to a brownish-yellow. *Purified pepsin,* or *scaly pepsin,* is made by redissolving the pepsin in acidulated water and precipitating as before, immersing the product when perfectly dry in pure water for a short time, after which it is rapidly dried, and is in the form of yellowish scales.

Pepsinum. *U. S.*	Odor, Taste, and Reaction.	Solubility.
A fine, white, or yellowish-white, amorphous powder, or thin, pale yellow or yellowish, transparent or translucent grains or scales. It slowly attracts moisture when exposed to the air. On heating a solution of Pepsin in acidulated water to 100° C. (212° F.), it becomes milky, or yields a light, flocculent precipitate, and loses all proteolytic power. In a dry state it can bear this temperature without injury.	Slight but not disagreeable odor; a mildly acidulous or slightly saline taste, usually followed by a suggestion of bitterness. It may be neutral, but should never be alkaline.	Soluble, or for the most part soluble, in about 100 parts of water, with more or less opalescence; more soluble in water acidulated with hydrochloric acid; insoluble in alcohol, ether, or chloroform.

Valuation of Pepsin.
Prepare, first, the following three solutions: *A.* To 294 C.c. of water add 6 C.c. of diluted hydrochloric acid. *B.* In 100 C.c. of solution *A* dissolve 0.067 Gm. of the Pepsin to be tested. *C.* To 95 C.c. of solution *A*, brought to a temperature of 40° C. (104° F.), add 5 C.c. of solution *B*. The resulting 100 C.c. of liquid will contain 2 C.c. of diluted hydrochloric acid, 0.00335 Gm. of the Pepsin to be tested, and 98 C.c. of water. Immerse and keep a fresh hen's egg during fifteen minutes in boiling water; then remove it and place it into cold

VALUATION OF PEPSIN.—*Continued.*

water. When it is cold, separate the white, coagulated albumen, and rub it through a clean sieve having 30 meshes to the linear inch. Reject the first portion passing through the sieve. Weigh off 10 Gm. of the second, cleaner portion, place it in a flask of the capacity of about 200 C.c., then add one-half of solution *C*, and shake well, so as to distribute the coherent albumen evenly throughout the liquid. Then add the second half of solution *C*, and shake again, guarding against loss. Place the flask in a water-bath, or thermostat, kept at a temperature of 38° to 40° C. (100.4° to 104° F.), for six hours, and shake it gently every fifteen minutes. At the expiration of this time the albumen should have disappeared, leaving at most only a few, thin, insoluble flakes. (Trustworthy results, particularly in comparative trials, will be obtained only if the temperature be strictly maintained between the prescribed limits, and if the contents of the flasks be agitated uniformly, and in equal intervals of time.)

The relative proteolytic power of Pepsin stronger or weaker than that described above may be determined by ascertaining, through repeated trials, how much of solution *B* made up to 100 C.c. with solution *A* will be required exactly to dissolve 10 Gm. of coagulated and disintegrated albumen under the conditions given above.

Uses.—Pepsin is used to aid the digestion of food, and is given in dyspepsia, in doses of three to thirty grains (0.19 to 1.9 Gm.).

PEPSINUM SACCHARATUM. *U. S.* Saccharated Pepsin.

	Metric.	Old form.
Pepsin	10 Gm.	1 oz. av.
Sugar of Milk, recently dried, and in No. 80 powder	90 Gm.	9 oz. av.
To make	100 Gm.	10 oz. av.

Triturate the Pepsin with the Sugar of Milk to a fine uniform powder. Keep the product in well-stoppered bottles.

This is simply pepsin of a definite strength reduced with sugar of milk, so that ten grains represent one grain of pepsin. Saccharated pepsin, when tested by the process given under Pepsin (see *Pepsinum*), with the modification that 0.67 Gm. of it are to be taken in preparing solution *B*, should digest 300 times its own weight of freshly coagulated and disintegrated egg albumen.

PANCREATINUM. *U. S.* Pancreatin.

A mixture of the enzymes naturally existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog (*Sus scrofa* Linné; class *Mammalia;* order *Pachydermata*).

Pancreatin is believed to be a mixture of the peculiar ferments or enzymes found in the pancreatic juice, the liquid which is secreted by the pancreas or *sweetbread*. These enzymes have been termed *trypsin*, *amylopsin*, and *steapsin*. Pancreatin digests albuminoids and converts starch into glucose. Prolonged contact with mineral acids renders it inert.

Pancreatinum. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Alcohol.
A yellowish, yellowish-white, or grayish, amorphous powder.	Odorless, or having a faint, peculiar, not unpleasant odor, and a somewhat meat-like taste.	Completely but slowly soluble in water.	Insoluble.

Tests.

If there be added to 100 C.c. of tepid water contained in a flask 0.28 Gm. of Pancreatin and 1.5 Gm. of sodium bicarbonate, and afterwards 400 C.c. of fresh cow's milk previously heated to 38° C. (100.4° F.), and if this mixture be maintained at the same temperature for thirty minutes, the milk should be so completely peptonized, that, if a small portion of it be transferred to a test-tube and mixed with some nitric acid, no coagulation should occur.

Peptonized milk, prepared in the manner just described, or even when the process is allowed to go on to the development of a very distinct bitter flavor, should not have an odor suggestive of rancidity.

Uses.—Pancreatin is used to aid digestion: it should not be given in combination with acids; weak alkalies assist its action.

MOSCHUS. *U. S.* Musk.

The dried secretion from the preputial follicles of *Moschus moschiferus* Linné (class *Mammalia;* order *Ruminantia*).

Musk contains cholesterin, ammonia, an acid principle, wax, fat, albuminous and gelatinous principles, and an odorous matter not yet determined. About 10 per cent. of Musk is soluble in alcohol, the tincture being light brownish-yellow, and on the addition of water becoming slightly turbid. About 50 per cent. of Musk is soluble in water, the solution being deep brown, faintly acid, and strongly odorous. When ignited with free access of air, Musk gives off a peculiar, somewhat urinous odor, and leaves behind not more than 8 per cent. of a grayish ash.

Musk is antispasmodic and stimulant. Dose, five to fifteen grains (0.3 to 0.9 Gm.).

Official Preparation.

Tinctura Moschi . . Tincture of Musk.	Made by macerating 50 Gm. of musk with sufficient diluted alcohol to make 1000 C.c. (see page 372). Dose, thirty minims to two fluidrachms (1.8 to 7.3 C.c.).

ACIDUM LACTICUM. *U. S.* Lactic Acid.

An organic acid, usually obtained by subjecting milk-sugar or grape-sugar to lactic fermentation; composed of 75 per cent., by weight, of absolute Lactic Acid [$HC_3H_5O_3$ = 89.79], and 25 per cent. of water.

Preparation.—Lactic acid may be made from sour milk, cheese, meat-juice, lactin, and from many vegetable products. Formerly it was obtained from cheese, and owing to its frequent occurrence in the decomposition of animal products it is considered here. It is now most conveniently prepared by treating cane-sugar with sulphuric acid, so as to convert it into invert sugar, then adding solution of caustic soda and heating the mixture until it ceases to precipitate Fehling's solution, showing the absence of sugar. Sulphuric acid is added, and the sodium sulphate formed is crystallized out, an addition of alcohol causing the precipitation of the remainder. The alcoholic liquid contains impure lactic acid: one-half of it is heated and zinc carbonate added until effervescence ceases; the other half of the alcoholic liquid is now added and the whole allowed to cool. Zinc lactate crystallizes

out; this, by treatment with hydrogen sulphide, yields zinc sulphide, lactic acid remaining in solution.

Acidum Lacticum. *U. S.*	Odor, Taste, and Reaction.	Solubility. Water.	Alcohol.	Other Solvents.
A colorless, syrupy liquid, absorbing moisture on exposure to damp air. Sp. gr. 1.213.	Odorless; very acid taste; acid reaction.	Freely miscible.	Freely miscible.	Freely miscible with ether, but insoluble in chloroform, benzin, or carbon disulphide.

Tests for Identity and Quantitative Test.	Impurities.	Tests for Impurities.
It is not vaporized by a heat below 160° C. (320° F.); at higher temperatures it emits inflammable vapors, then chars, and is finally entirely volatilized; 5 Gm., after combustion, should not leave more than 0.05 Gm. of residue. On adding some potassium permanganate to a mixture of equal volumes of Lactic and sulphuric acids, and gently heating, the odor of aldehyde becomes perceptible. To neutralize 4.5 Gm. of Lactic Acid should require 37.5 C.c. of potassium hydrate V.S. (each C.c. corresponding to 2 per cent. of absolute acid), phenolphtalein being used as indicator.	Chloride.	10 C.c. of a 1-per-cent. aqueous solution of the Acid should not be rendered opalescent by the addition of 1 C.c. of silver nitrate T.S.
	Sulphate.	10 C.c. of a 10-per-cent. aqueous solution should remain unaffected by 1 C.c. of barium chloride T.S.,
	Sarcolactic Acid.	Nor should the above solution be affected by 1 C.c. of copper sulphate T.S.
	Lead, Iron, etc.	No precipitate in the same aqueous solution by 1 C.c. of ammonium sulphide T.S., after addition of excess of ammonia.
	Sugars.	On adding a few drops of the Acid to 10 C.c. of hot alkaline cupric tartrate V.S., no red cuprous oxide should be separated.
	Glycerin.	When mixed and heated with excess of zinc carbonate, and the mixture dried at 100° C. (210° F.), and extracted with absolute alcohol, the latter should not leave a sweet residue on evaporation.
	Organic Impurities.	Cold, concentrated sulphuric acid shaken with an equal volume of Lactic Acid should assume at most only a pale yellow color.

Uses.—Lactic acid is chiefly used to form the lactates, which are believed to be more easily assimilated than most salts. It is rarely prescribed alone, but may be given in doses of one to three fluidrachms, largely diluted. It is used in preparing syrup of calcium lactophosphate.

SACCHARUM LACTIS. *U. S.* Sugar of Milk.

$$C_{12}H_{22}O_{11} + H_2O = 359.16.$$

A peculiar crystalline sugar, obtained from the whey of cow's milk by evaporation, and purified by recrystallization.

Preparation.—Sugar of milk is prepared from the whey of cow's milk. By the addition of diluted sulphuric acid and subsequent evaporation the albuminous matter is coagulated; this is filtered out and the liquid set aside to crystallize. Animal charcoal is sometimes used to decolorize the solution.

Saccharum Lactis. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Water.	Other Solvents.
White, hard, crystalline masses, yielding a white powder feeling gritty on the tongue, permanent in the air.	Odorless; faintly sweet taste; neutral reaction.	At 15° C. (59° F.), 6 parts. Boiling, 1 part.	Insoluble in alcohol, ether, or chloroform.

Tests for Identity.	Impurities.	Test for Impurities.
On adding to a few C.c. of a hot, saturated, aqueous solution of Sugar of Milk an equal volume of sodium hydrate T.S., and gently warming, the liquid will turn yellow and brownish-red. On the further addition of a few drops of copper sulphate T.S., a brick-red precipitate will appear.	Cane-Sugar.	If about 1 Gm. of powdered Sugar of Milk be sprinkled upon about 5 C.c. of cold sulphuric acid contained in a flat-bottomed capsule, the acid may acquire a greenish or reddish, but no brown or brownish-black, color within half an hour.

Uses.—Sugar of milk is a useful diluent, and is largely used in medicine and pharmacy. The hardness of the crystals is of great assistance in securing thorough admixture of the ingredients in compound powders, by necessitating prolonged trituration.

FEL BOVIS. *U. S.* Oxgall. [Fel Tauri.]

The fresh bile of *Bos Taurus* Linné (class *Mammalia;* order *Ruminantia*).

Oxgall is of complex chemical composition, the most important constituents being the sodium salts of resinous acids, or gall acids, and coloring-matters. These acids are as follows: *glycocholic acid,* $C_{26}H_{43}NO_6$, *taurocholic acid,* $C_{26}N_{45}NSO_7$, *hyoglycocholic acid,* $C_{27}H_{43}NO_5$, *hyotaurocholic acid,* $C_{27}H_{45}NSO_6$, and *chenotaurocholic acid,* $C_{29}H_{49}NSO_6$.

Oxgall is officially described as a brownish-green or dark green, somewhat viscid liquid, having a peculiar odor, a disagreeable, bitter taste, and a neutral or faintly alkaline reaction. Sp. gr. 1.018–1.028. A mixture of 2 drops of Oxgall and 10 C.c. of water, when treated first with a drop of freshly prepared solution of 1 part of sugar in 4 parts of water, and afterwards with sulphuric acid, cautiously added, until the precipitate first formed is redissolved, gradually acquires a brownish-red color, changing successively to carmine, purple, and violet.

It is used in making the succeeding preparation.

FEL BOVIS PURIFICATUM. *U. S.* Purified Oxgall.

	Metric.	Old form.
Fresh Oxgall	300 C.c.	8 fl. oz.
Alcohol	100 C.c.	1 fl. oz.

Evaporate the Oxgall, in a tared porcelain capsule, on a water-bath, to about 100 Gm. [old form 1 oz. av.], then add to it the Alcohol, mix the whole thoroughly, and set it aside, well covered, for three or four days. Then decant the clear solution, filter the remainder, and,

having mixed the liquids and distilled off the Alcohol, evaporate the remainder to a pilular consistence.

The addition of alcohol to the concentrated liquid is for the purpose of separating mucilaginous matter.

The official description and tests are as follows: A yellowish-green, soft solid, having a peculiar odor, and a partly sweet and partly bitter taste. It is very soluble in water and in alcohol. A solution of 1 part of Purified Oxgall in about 100 parts of water behaves towards sugar and sulphuric acid like the solution mentioned under Oxgall. (See Fel Bovis.) The aqueous solution of Purified Oxgall should yield no precipitate on the addition of alcohol.

Uses.—Oxgall is not used so extensively as it was at one time. It is administered with the intention of supplying a deficiency of bile in the intestines, in certain indications. Its usefulness is questionable. The dose is ten to fifteen grains (0.6 to 0.97 Gm.).

CETACEUM. *U. S.* Spermaceti.

A peculiar, concrete, fatty substance, obtained from *Physeter macrocephalus* Linné (class *Mammalia*; order *Cetacea*).

Preparation.—Spermaceti is made by the forcible expression of the oleaginous compound found in the head of the sperm-whale to separate the olein: the solid fat is termed *cetin*.

Spermaceti is a mixture of various fats. When recrystallized from alcohol, *cetin* is obtained, while the alcohol on evaporation deposits an oil, *cetin-elain*, which when saponified yields *cetin-elaic acid*, an acid resembling, but distinct from, oleic acid. The cetin which crystallizes out of the alcohol is essentially *cetyl palmitate*, $C_{16}H_{33}(C_{16}H_{31}O_2)$. There are small amounts of fats containing *stearic acid*, $C_{18}H_{36}O_2$, *myristic acid*, $C_{14}H_{28}O$, and *lauro-stearic acid*, $C_{12}H_{24}O_2$, with the alcohol radicals corresponding to these acids.

Uses.—Spermaceti is one of the solid fatty substances employed to give consistency to cerates and ointments: it is used in the well-known ointment of rose-water, or cold cream.

Cetaceum. *U. S.*	Odor, Taste, and Reaction.	Solubility.		
		Water.	Alcohol.	Other Solvents.
White, somewhat translucent, slightly unctuous masses of a scaly-crystalline fracture and a pearly lustre. Becomes yellow and rancid by exposure to air. Specific gravity about 0.945 at 15° C. (59° F.). Melts near 50° C. (122° F.), and congeals near 45° C. (113° F.).	Odorless; bland, mild taste; neutral reaction.	Insoluble.	Cold, Nearly insoluble. Boiling, Soluble.	Soluble in ether, chloroform, carbon disulphide, fixed and volatile oils; only slightly soluble in cold benzin.

Impurity.	Tests for Impurity.
Stearic Acid.	If 1 Gm. of Spermaceti be boiled with 1 Gm. of anhydrous sodium carbonate and 50 C.c. of alcohol, and the mixture cooled and filtered, the filtrate, upon being supersaturated with acetic acid, may become turbid, but should not afford a precipitate.

Official Preparation.

Ceratum Cetacei . . Spermaceti Cerate.	Made by melting together 100 Gm. of spermaceti, 350 Gm. of white wax, and 550 Gm. of olive oil. (See Cerata.)

Official Products of the Class Pisces.

ICHTHYOCOLLA. *U.S.* Isinglass.

The swimming-bladder of *Acipenser Huso* Linné, and of other species of *Acipenser* (class *Pisces*; order *Sturiones*).

Preparation.—Russian isinglass is the kind designated by the Pharmacopœia: it is made by washing and drying the swimming-bladders or air-bags of the Russian sturgeon, by stretching them upon flat boards to dry. It is described as in separate sheets, sometimes rolled, of a horny or pearly appearance; whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; almost entirely soluble in boiling water and in boiling diluted alcohol. The solution in 24 parts of boiling water forms, on cooling, a transparent jelly.

American isinglass is in flat, ribbon-like bands, having somewhat the appearance of rolled and rumpled thin manilla paper: it has a fishy odor, and is much inferior to the official isinglass.

Isinglass is the purest form of gelatin attainable: it is used in making court-plaster, and, owing to its forming an insoluble compound with tannin, is employed in clarifying coffee and other similar liquids.

Official Preparation.

Emplastrum Ichthyocollæ . Isinglass Plaster. (Court Plaster.)	Made by dissolving 10 Gm. of isinglass in sufficient hot water to make 120 Gm., coating taffeta with one-half of the solution, then mixing the other half with 40 Gm. of alcohol and 1 Gm. of glycerin and applying it in successive layers. The reverse side of the taffeta is coated with tincture of benzoin.

OLEUM MORRHUÆ. *U.S.* Cod Liver Oil.

[Oleum Jecoris Aselli.]

A fixed oil obtained from the fresh livers of *Gadus Morrhua* Linné, or of other species of *Gadus* (class *Pisces*; order *Teleostei*; family *Gadidæ*).

Preparation.—The best method of preparing cod liver oil is to heat the livers in a wooden tank by means of low-pressure steam. The resulting mass is carefully drained,—the livers themselves containing, besides oil, a considerable portion of watery fluid, which passes off with it in the form of emulsion and separates on standing. In the case of the finest varieties, the oil, which is made only in the winter months, is drawn off by taps from the bottom of the cooking-tank and then put into a cooling-house to freeze. The solid frozen mass is put into canvas bags, and submitted, whilst at a low temperature, to severe pressure, whereby the pure oil is expressed. This constitutes the light oil of commerce.

Cod liver oil consists chiefly of olein. Palmitin and stearin are present in small proportions; minute traces of iodine, chlorine, bromine, phosphorus, and sulphur are found, but these are not in sufficient quantity to have any medicinal effect. Recent investigators assert

that cod liver oil owes its virtues to the alkaloids *aselline* and *morrhuine* associated with morrhuic, formic, butyric, and phosphoric acids. Preparations are upon the market containing these substances and free from any of the oil or oily constituents. Very valuable results have been claimed for these preparations.

Oleum Morrhuæ. *U. S.*	Odor, Taste, and Reaction.	Solubility.	
		Alcohol.	Other Solvents.
A pale yellow, thin, oily liquid. Sp. gr. 0.920–0.925 at 15° C. (59° F.).	Peculiar, slightly fishy, but not rancid odor; bland, slightly fishy taste; faintly acid reaction.	Scarcely soluble.	Readily soluble in ether, chloroform, or carbon disulphide; also in 2.5 parts of acetic ether.

Tests for Identity.	Impurities.	Test for Impurities.
If 1 drop of the Oil be dissolved in 20 drops of chloroform, and the solution shaken with 1 drop of sulphuric acid, the solution will acquire a violet-red tint, rapidly changing to rose-red and brownish-yellow. If a glass rod, moistened with sulphuric acid, be drawn through a few drops of the Oil, on a porcelain plate, a violet color will be produced. If 2 or 3 drops of fuming nitric acid be allowed to flow alongside of 10 or 15 drops of the Oil, contained in a watch-glass, a red color will be produced at the point of contact. On stirring the mixture with a glass rod, this color becomes bright rose-red, soon changing to lemon-yellow (distinction from *seal oil*, which shows at first no change of color, and from *other fish oils*, which become at first blue, and afterwards brown and yellow).	Other Fish Oils and many Vegetable Oils.	When the Oil is allowed to stand for some time at 0° C. (32° F.), very little or no solid fat should separate.

Uses.—Cod liver oil is used as a nutrient and alterative in wasting diseases, notably phthisis. Dose, one to four fluidrachms (3.7 to 14.7 C.c.).

Official Products of the Class Aves.

VITELLUS. *U. S.* Yolk of Egg.

The yolk of the egg of *Gallus Bankiva* var. *domesticus* Temminck (class *Aves*; order *Gallinæ*).

Yolk of egg contains *vitellin*, a protein compound resembling casein, albumen, fat, cholesterin, inorganic salts, coloring-matter, etc. There is also present water in the proportion of about 50 per cent. *White of egg* consists principally of albumen with 80 per cent. of water. The inorganic salt present in largest proportion is potassium chloride.

Uses.—Yolk of egg is valuable in pharmacy as an emulsifying agent, its value lying chiefly in the fact of its being an excellent nucleus and a perfect natural emulsion. (See Emulsions, Part V.)

Official Preparation.

Glyceritum Vitelli . . . . Glycerite of Yolk of Egg.	45 Gm. of fresh yolk of egg and 55 Gm. of glycerin. Mix well, and express through muslin.

Official Products of the Class Insecta.

CANTHARIS. *U. S.* Cantharides. [SPANISH FLIES.]

Cantharis vesicatoria De Geer (class *Insecta*; order *Coleoptera*.)
Cantharides should be thoroughly dried at a temperature not exceeding 40° C. (104° F.), and kept in well-closed vessels.

Cantharides owe their blistering properties to *cantharidin*, $C_{10}H_{12}O_4$. This is a white substance, in the form of crystalline scales, of a shining micaceous appearance, inodorous, tasteless, almost insoluble in water and in cold alcohol, but soluble in ether, chloroform, benzol, formic and glacial acetic acids, the oils, and in hot alcohol, which deposits it upon cooling. It fuses at 210° C. (410° F.), is volatilizable by heat without decomposition, and its vapor condenses in acicular crystals. The subliming point of isolated cantharidin is 100° C. (212° F.), or the temperature of boiling water. Cantharidin is believed to be the anhydride of cantharidic acid. The latter forms definite salts with bases: these may be obtained by heating cantharidin with alkaline solutions. The most satisfactory test of cantharidin is its vesicating property.

Uses.—Cantharides are aphrodisiac and poisonous: when applied externally they produce vesication.

Official Preparations.

Ceratum Cantharidis . . . . Cantharides Cerate.	320 Gm. of cantharides, 180 Gm. of yellow wax, 180 Gm. of resin, 220 Gm. of lard, and 150 C.c. of oil of turpentine. Moisten the cantharides with the oil of turpentine and set aside for 48 hours, then add it to the wax, resin, and lard, strain through muslin, and keep the mixture in a melted state for half an hour, or until reduced to 1000 Gm., then stir until cold. (See Cerata.)
Collodium Cantharidatum . Cantharidal Collodion.	(See page 338.)
Tinctura Cantharidis . . . Tincture of Cantharides.	Made by percolating 50 Gm. of powdered cantharides with sufficient alcohol to make 1000 C.c. (see page 363). Dose, three to ten minims (0.18 to 0.6 C.c.).

COCCUS. *U. S.* Cochineal.

The dried female of *Coccus cacti* Linné (Class, *Insecta*; Order, *Hemiptera*).

The odor of cochineal is faint; its taste slightly bitterish. It contains a red coloring-matter soluble in water, alcohol, and water of ammonia, slightly soluble in ether, insoluble in fixed and volatile oils. On macerating Cochineal in water, the insect swells up, but no insoluble powder should be separated.

Cochineal owes its red color to *carminic acid*, $C_{17}H_{18}O_{10}$. It contains mucilage, fat, inorganic salts, etc. Its only use in pharmacy is to impart a bright red color to various preparations, like compound tincture of cardamom, elixirs, etc.

CERA FLAVA. *U. S.* Yellow Wax.

A peculiar, concrete substance, prepared by *Apis mellifica* Linné (Class, *Insecta*; Order, *Hymenoptera*).

CERA ALBA. *U. S.* White Wax.

Yellow wax, bleached.

Preparation.—Wax is now known to be a peculiar secretion of bees. Yellow wax is obtained on the large scale by first abstracting the honey from the combs by shaving off the ends of the cells, draining, and then placing them in centrifugals. The honey is rapidly whirled out, water is added, and the wax is thoroughly and quickly cleaned; it is then melted and strained and run into flat dishes or moulds to cool and harden.

Beeswax is a mixture of three different substances, which may be separated from one another by alcohol,—viz.: 1, *myricin*, insoluble in boiling alcohol, and consisting chiefly of myricyl palmitate, $C_{30}H_{61}(C_{16}H_{31}O_2)$, which is a compound of *palmitic acid*, $C_{16}H_{32}O_2$, and *myricyl alcohol*, $C_{30}H_{62}O$; 2, *cerotic acid*, $C_{27}H_{54}O_2$ (formerly called *cerin* when obtained only in an impure state), which is dissolved by boiling alcohol, but crystallizes out on cooling; 3, *cerolein*, which remains dissolved in the cold alcoholic liquid. This latter is probably a mixture of fatty acids, as indicated by its acid reaction to litmus paper.

Cera Flava. *U. S.*	Odor and Taste.	Solubility. Water.	Solubility. Alcohol.	Solubility. Other Solvents.
A yellowish to brownish-yellow solid. It is brittle when cold, and when broken presents a dull, granular, not crystalline fracture, but becomes plastic by the heat of the hand. It melts at 63°–64° C. (145.4°–147.2° F.). Sp. gr. 0.955–0.967 at 15° C. (59° F.).	Agreeable, honey-like odor; faint, balsamic taste.	Insoluble.	Cold, Only partially soluble. Boiling, Almost completely soluble.	Completely soluble in ether, chloroform, and in fixed and volatile oils. Partially soluble in cold benzol or carbon disulphide, and completely in these liquids at a temperature of 25° to 30° C. (77° to 86° F.).

Impurities.	Tests for Impurities.
Fats, or Fatty Acids, Japan Wax, Resin.	If 1 Gm. of Yellow Wax be boiled for half an hour with 35 C.c. of a 15-per-cent. aqueous solution of sodium hydrate, the volume being preserved by the occasional addition of water, the Wax should separate, on cooling, without rendering the liquid opaque, and no precipitate should be produced in the filtered liquid by hydrochloric acid.
Soap.	The above reagent should not produce a precipitate in water which has been boiled with a portion of the Wax.
Paraffin.	If 5 Gm. of Yellow Wax be heated in a flask for fifteen minutes with 25 C.c. of sulphuric acid to 160° C. (320° F.), and the mixture then diluted with water, no solid, wax-like body should separate.
Tallow and Other Fats.	If a portion of Yellow Wax be ignited on platinum, it should not emit the odor of acrolein.

White Wax.—The color of yellow wax is discharged by exposing it with an extended surface to the combined influence of air, light, and moisture. The process of bleaching is often conducted upon a large scale. The wax, previously melted, is made to fall in streams upon a revolving cylinder kept constantly wet, upon which it con-

cretes, forming thin layers. These, having been removed, are spread upon linen cloths stretched on frames, and exposed to the air and light, care being taken to wet and occasionally turn them. In a few days they are partially bleached; but to deprive the wax completely of color it is necessary to repeat the whole process once, if not oftener. When sufficiently white, it is melted and cast into small circular cakes.

It is a yellowish-white solid, generally in the form of circular cakes, about four inches (10 cm.) in diameter, somewhat translucent in thin layers, having a slightly rancid odor and an insipid taste. It melts at about 65° C. (149° F.). Sp. gr. 0.965–0.975. In other respects it has the characteristics and answers to the tests mentioned under Yellow Wax (see above).

Uses.—Wax is used in pharmacy principally to give consistence to cerates and ointments.

Unofficial Animal Products.

Class Mammalia.

Acidum Butyricum, $C_4H_8O_2$. Butyric acid.	a colorless liquid, having a disagreeable odor and a rancid taste. Density, 0.973.
Ambra Grisea. Ambergris.	A morbid excretion from the intestines of *Physeter macrocephalus*, found floating on the sea. It is friable when cold, of a gray or brown-gray color. It contains 85 per cent. of ambrein, etc. Used in perfumery.
Sanguis. Blood.	The arterial fluid of the ox, *Bos Taurus*. It is of a red color, opaque, and has a peculiar odor. It contains 78 per cent. of water, 8 per cent. of albumen, 5 per cent. of fibrin, etc. The red color is due to *hæmoglobin*.
Butyrum. Butter.	From the milk of the cow, *Bos Taurus*. Obtained by allowing the cream to separate from the milk, collecting and churning. A soft, yellow, neutral substance, of a pleasant, sweet odor and a bland taste. It contains 30 per cent. of olein, and about 68 per cent. of palmitin and stearin, etc.
Castoreum. Castor.	From the preputial follicles of both the male and female animals *Castor Fiber*. The follicles occur in pairs, are pyriform, of a brown or blackish color, a peculiar odor, and a bitter, acrid, and nauseous taste. It contains a volatile oil, and from 15 to 40 per cent. of a bitterish resinous substance, etc.
Civetta. Civet.	An odorous substance obtained from two animals of the genus *Viverra* which inhabit the East Indies. It is semi-solid, unctuous, yellowish, becoming brown and thicker by exposure to air; of a very strong, peculiar odor, and a bitterish, acrid, and nauseous taste. It contains volatile oil, and resinous and other matters. Used in perfumery.
Extractum Carnis. Extract of Beef.	Prepared by subjecting beef contained in iron cylinders heated by steam to a temperature of 220° F. for several hours, collecting, when cool, the solidified juice, and preserving it in well-closed cans.
Fibrin.	Obtained when blood is allowed to coagulate or is whipped with a bundle of twigs. It is at first, when pure, a gelatinous mass, which changes to a white, tenacious material, consisting of minute fibrils.
Gelatina. Gelatin.	Obtained by boiling in water, bone, skins, cartilage, tendons, etc., until dissolved, then drying the resulting jelly in the air. It occurs in thin, transparent sheets. The different varieties which occur in commerce are Russian, French, Cooper's, and Coxe's gelatin.
Hæmoglobin, from the blood of swine, $C_{600}H_{1006}N_{150}S_2$-$FeO_{17}$. From dog's blood, $C_{636}H_{1025}N_{164}S_3$-$FeO_{189}$.	Used as a substitute for iron in the treatment of anæmia. Dose, one and a half grains (0.09 Gm.).
Hæmol and Hæmogallol.	Two blood preparations containing iron.
Hyraceum. Hyraceum.	The product of *Hyrax capensis*, an animal of Southern Africa. It is found on the rugged sides of mountains, and is supposed to be the excrement or the dried urine of the animal. It is rather hard, tenacious, of a blackish-brown color, and of a taste and smell similar to those of castor.

Unofficial Animal Products.—*Continued.*

Ingluvin.	From the gizzards of *Gallus Bankiva*. Prepared by a process similar to that employed in preparing pepsin. The dried and powdered gizzards are often used as digestives.
Kefir.	A peculiar fermented milk, having all the virtues of Koumys.
Keratin.	The organic basis of horny tissues, hair, nails, feathers, epithelium, etc. Used for coating pills so as to enable them to pass through the acid juices of the stomach and be dissolved in the alkaline intestinal fluids.
Koumys. **Kumys.** **Koumiss.**	Prepared by dissolving 4 ounces of white sugar in 1 gallon of skimmed milk and placing in bottles of the capacity of 1 quart; add 2 ounces of baker's yeast, or a cake of compressed yeast, to each bottle, cork and tie securely, then set in a warm place until fermentation is well under way; then lay the bottles on their sides in a cool cellar. In three days fermentation will have progressed sufficiently to permit the koumys to be in good condition.
Lac. **Milk.**	From the mammary glands of the cow, *Bos Taurus*. It is a white, opaque liquid, having a slight odor and a bland and sweet taste. Sp. gr. 1.030. It contains 85 per cent. of water and about 15 per cent. of solids.
Milk-Casein.	The most abundant of the albuminoids obtained from milk by the addition of rennet.
Neat's-foot Oil.	Prepared by boiling the feet of cattle, deprived of their hoofs, with water, removing the oil which rises to the surface, and allowing it to remain for some time in warm water. Used for softening leather.
Paraglobulin.	Obtained from blood serum, lymph, chyle, etc. It is a granular substance, gradually becoming more compact.
Peptones.	The product of the action of gastric and pancreatic juices, or of pepsin alone, upon albuminoids during the process of digestion.
Ptomaines. **Cadaveric Alkaloids.**	Alkaloidal substances found in dead bodies or decomposed animal matter, as choline, muscarine, neurine, gadinine, tetanine, dimethylamine, trimethylamine, triethylamine, putrescine, cadaverine, saprine, neuridine, collidine, hydrocollidine, parvoline, and tyrotoxicon (diabenzene).
Ptyalin.	A fermentative substance occurring in saliva, and having the power of converting starch into dextrin.
Sodii Choleas. **Sodium Choleate.**	Prepared by evaporating fresh oxgall to one-half, and precipitating the slimy and coloring matters with an equal bulk of alcohol, treating the filtrate with animal charcoal, distilling off the alcohol, and washing the residue with ether. It occurs as a white, sticky mass, having a penetrating odor, and a peculiar, sweetish, afterwards bitter taste. (See Fel Bovis Purificatum.)
Spongia.	Used mechanically. In the shape of sponge tent it is employed for dilating sinuses.
Thiol, also Ichthyol.	Antirheumatic, and used for the same purposes as ichthyol. Dose of liquid thiol, five to ten drops, or of the dried preparation, one to two grains.
Thiolinic Acid.	Used as a substitute for thiol and ichthyol. It has been called sulphurated linseed oil.
Urea, **Carbamide,** **$CO(NH_2)_2$.**	A hydragogue diuretic. Dose, ten grains (0.648 Gm.) every six hours.
Sperm Oil.	From the cranial cavities of *Physeter macrocephalus*. It is of a yellow or brown-yellow color. Sp. gr. 0.920. On cooling, it deposits spermaceti and stearin.
Whale Oil.	From *Balæna mysticetus*. It has a peculiar fishy odor and unpleasant taste.
Porpoise Oil.	From *Delphinus Phocæna*. Prepared by heating the belly-blubber of the porpoise. It is, when fresh, of a pale yellow color.
Seal Oil.	From *Phoca* of various species.
Dugong Oil.	From *Halicore Dugong*. Habitat, waters of Eastern Australia. This oil is generally used as a substitute for cod liver oil in Australia.
Class Pisces.	
Eulachon Oil.	From *Thaleichthys Pacificus*, a small fish found on the Pacific coast. This oil has been proposed as a substitute for cod liver oil.
Menhaden Oil.	From *Alosa Menhaden*. Habitat, Atlantic coast. Used in dressing leather.
Shark Oil.	From the livei of the shark, *Squalis Carcharias*, and other species. It is of a light yellow color, and has an acrid taste. Sp. gr. 0.870–0.880.
Skate Oil.	From the liver of *Raja Batis*. Employed largely in France and Belgium. It is of a bright yellow color. Sp. gr. 0.928.
Lipanin.	A mixture of 100 parts of olive oil and 6 parts of oleic acid. Used as a substitute for cod-liver oil. Dose, one to four fluidrachms (3.69 to 14.7 C.c.).

Unofficial Animal Products.—*Continued.*

Class Aves.	
Albumen Ovi. Egg-Albumen.	It exists in solution, enclosed in a net-work of delicate membranes, in the white of eggs.
Vitellin.	It exists in the yolk of eggs. Closely resembles fibrin.
Class Insecta.	
Acidum Formicum. Formic Acid.	Obtained by distilling the ant (*Formica rufa*). It is a colorless liquid, having a pungent odor, and produces a burning sensation when applied to the skin. Its vapor is inflammable. Used for neuralgic and rheumatic pains.
Cobweb.	The web of *Tegeneria domestica*. It has been recommended in phthisis and chronic intermittents, but is most useful in controlling hemorrhage by simply applying it to the bleeding surfaces.
Blatta. Cockroach.	The insect *Blatta orientalis*, about one inch long, oblong, flat, of a reddish-black color, odor very disagreeable. It contains fetid oil, extractive, antihydropin, etc. Used as a diuretic.
Red Ant.	The insect *Formica rufa*. It contains a volatile oil and formic acid.
Class Reptilia.	
Crotalus.	Prepared from the venom of the rattlesnake (*Crotalus horridus*). While the snake is under chloroform the poison contained in the fang is pressed out and mixed with 9 parts of glycerin. Used in diphtheritic scarlatina.
Phynin.	From the glandular secretion and dried skin of the toad (*Bufo viridis* and *B. cinereus*). Similar in its effects to digitalin.
Class Annelida.	
Hirudo. Leech.	From *Sanguisuga medicinalis* and *S. officinalis*. From three to six inches long, smooth, soft, round, tapering at the ends, composed of about one hundred rings; of a blackish-green color. Used for local depletion.

Official Animal Subetances.

Official Name.	Class and Order.	Part Used.	English Name.	Official Preparations.
Acidum Lacticum.			Lactic Acid.	Syrup of Calcium Lactophosphate.
Acidum Oleicum.			Oleic Acid.	Oleate of Mercury, Oleate of Veratrine, Oleate of Zinc.
Adeps.	Class Mammalia. Order Pachydermata.	Prepared internal fat.	Lard.	Benzoinated Lard, Cerate, Camphor Cerate, Resin Cerate, Ointment, Cantharides Cerate, Mercurial Ointment, Tar Ointment.
Adeps Lanæ Hydrosus.	Class Mammalia.	Purified fat of the wool of sheep.	Hydrous Wool-Fat.	
Cantharis.	Class Insecta. Order Coleoptera.		Cantharides.	Cerate, Collodion, Tincture.
Carbo Animalis.		Prepared from bone.	Animal Charcoal.	Purified Animal Charcoal.
Cera Alba.		Yellow wax bleached.	White Wax.	Cerate, Camphor Cerate, Spermaceti Cerate, Ointment of Rose Water.
Cera Flava.	Class Insecta. Order Hymenoptera.	Prepared concrete substance.	Yellow Wax.	Resin Cerate, Ointment, Cantharides Cerate, Burgundy Pitch Plaster, Resin Plaster, Tar Ointment.
Cetaceum.	Class Mammalia. Order Cetacea.	Concrete fatty substance.	Spermaceti.	Cerate, Ointment of Rose Water.
Coccus.	Class Insecta. Order Hemiptera.	Dried female.	Cochineal.	Compound Tincture of Cardamom.
Fel Bovis.	Class Mammalia. Order Ruminantia.	Fresh bile.	Oxgall.	Purified Oxgall.

Official Animal Substances.—*Continued.*

OFFICIAL NAME.	Class and Order.	Part Used.	English Name.	Official Preparations.
Glycerinum.			Glycerin.	**Suppositories**, Elixir of Phosphorus, Glycerites, and many preparations.
Ichthyocolla.	Class Pisces. Order Sturiones.	Swimming-bladder.	Isinglass.	**Plaster.**
Mel.	Class Insecta. Order Hymenoptera.	Saccharine secretion.	Honey.	Clarified Honey.
Moschus.	Class Mammalia. Order Ruminantia.	Dried secretion.	Musk.	**Tincture.**
Oleum Adipis.		Fixed oil.	Lard Oil.	Ointment of Mercuric Nitrate.
Oleum Morrhuæ.	Class Pisces. Order Teleostei.	Fixed oil.	Cod Liver Oil.	
Pancreatinum.	Class Mammalia. Order Pachydermata.	Enzymes from pancreas.	Pancreatin.	
Pepsinum.		Ferment from fresh stomach of the hog.	Pepsin.	Saccharated Pepsin.
Saccharum Lactis.			Sugar of Milk.	Extract of Nux Vomica, Extract of Opium, Saccharated Pepsin, Saccharated Ferrous Iodide, Deodorized Opium, Powder of Ipecac and Opium, Triturations.
Sevum.	Class Mammalia. Order Ruminantia.	Internal fat of abdomen.	Suet.	Mercurial Ointment.
Vitellus.	Class Aves. Order Gallinæ.	Yolk of the egg.	Yolk of Egg.	**Glycerite.**

QUESTIONS ON CHAPTER LXI.

PRODUCTS FROM ANIMAL SUBSTANCES.

Where are protein compounds found?
What are their constituents?
What are their physical properties?
What is Millon's reagent?
What color does it produce in contact with protein compounds?
From what classes are the animal products which are of interest in pharmacy derived?
Lard—What is the Latin name? Whence is it obtained?
How is it prepared?
What is the process, used largely in France, of purifying lard?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Alkalies; starch; salt; water.
Of what does lard consist?
To what is its consistence due?
For what is lard used in pharmacy?

Benzoinated lard—What is the Latin official name?
What was the name of this preparation in the U. S. P. 1870?
How is it prepared? What temperature should be used?
Does the method of adding tincture of benzoin to lard and mixing make as good a product as the official method? Why?
Lard oil—What is the Latin official name? How is it prepared?
Give description and specific gravity.
What is its usual adulteration?
Is this admixture particularly injurious?
What is the Latin official name of hydrous wool-fat?
How much water does it contain?
Suet—What is the Latin official name? Whence is it obtained, and how prepared?
Describe odor, taste, specific gravity, and solubility. Give tests for identity.
For what is it used?
What is pepsin, and whence obtained?
How much coagulated egg albumen should it be capable of digesting?
Saccharated pepsin—What is the Latin official name?
How much official pepsin does it contain?
Describe Prof. Scheffer's process for making it.
How is purified pepsin or scaly pepsin prepared?
Describe odor, taste, specific gravity, and solubility. Give tests for identity.
What is the dose?
Musk—What is the Latin official name? Whence is it obtained?
What does it contain? What is the dose? What are its official preparations?
Lactic acid—How much absolute acid does it contain?
How may it be made?
Describe odor, taste, specific gravity, and solubility. Give tests for identity.
How may the following impurities be detected?—viz.: Hydrochloric acid; sulphuric acid; sarcolactic acid; lead, iron; sugars; glycerin; organic impurities.
What is the dose?
Sugar of milk—What is the Latin name?
Give formula in symbols and molecular weight. Whence is it obtained?
How is it prepared?
Describe odor, taste, specific gravity, and solubility. Give tests for identity.
How may the presence of cane-sugar be detected?
What are its uses? Why is it specially useful in pharmacy?
Oxgall—What is the Latin official name? What are its constituents?
Describe odor, taste, and chemical reaction.
For what is it used?
Purified oxgall—What is the Latin official name? How is it prepared?
Describe odor, taste, and chemical reaction.
What is the official test for it? What is the dose?
Isinglass—What is the Latin official name? Whence is it derived?
How is it prepared?
What is the form of American isinglass?
For what purposes is it used? What are the official preparations?
Spermaceti—What is the Latin official name? Whence is it obtained?
Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility.
How is it made?
What is its composition? For what is it used?
What are its official preparations?
Cod liver oil—What is the Latin official name? Whence is it obtained?
How is it best prepared?
How is the light oil of commerce prepared?
What are its constituents? Give description and specific gravity.
Describe odor, taste, chemical reaction, and solubility. Give tests for identity.
What is the dose?
Yolk of egg—What is the Latin official name? What does it contain?
Of what does white of egg chiefly consist?
For what is yolk of egg useful in pharmacy?
What are its official preparations?
Cantharides—What is the Latin name? Whence is it obtained?
To what do cantharides owe their blistering properties?
Describe the physical properties of cantharidin.

What is cantharidin believed to be, chemically?
Does this acid form salts? How may they be obtained?
What is the most satisfactory test of cantharidin?
What are the medicinal properties of cantharides?
Name its official preparations.
Cochineal—What is the Latin name? What is its definition?
What does it contain?
To what does it owe its red color?
For what is it used?
Yellow wax—What is the Latin official name? Whence is it obtained?
White wax—What is the Latin official name? What is its definition?
What is wax? How is it obtained commercially?
What are the constituents of beeswax?
Which of these is soluble in alcohol?
Describe odor, taste, chemical reaction, and solubility.
How may the following impurities be detected?—viz.: Fats or fatty acids; Japan wax; resin; soap; paraffin.
How is white wax made? What is its specific gravity?
Describe odor, taste, and chemical reaction.
What is its principal use in pharmacy?

CHAPTER LXII.

PHARMACEUTICAL TESTING.

A KNOWLEDGE of the methods of using tests with the view of identifying or ascertaining the amount of impurities in articles of the materia medica, is now demanded of the pharmacist. The professional chemist can no longer claim the exclusive right to handle the test-tube and the burette, for the principles of analysis, so far as they relate to medicinal chemicals, must be understood by the practical pharmacist. It is not within the scope of this work to enter into the minute details of the application of each test, the many excellent works on analysis which have been issued within the last five years fully supplying all needs in this direction.[1]

The introduction of many new tests into the last Pharmacopœia, however, requiring the use of various reagents and test-solutions, necessitates a brief review of the methods employed in analysis, with some definitions of common terms.

Synthesis and Pharmacy treat of the creation or preparation of compounds by *building them up* from their constituents: thus, by heating together iodine and sulphur, the compound, sulphur iodide, is made.

Analysis is the opposite operation: it treats of the decomposition of the compound by *separating* its constituents: if sulphur iodide be boiled with water, the iodine will be volatilized and may be collected, whilst the sulphur remains with the water, and thus the compound is decomposed and its constituents are separated.

The principles of analysis are based upon the application of one chemical substance, of known properties and composition, to another, which results in some change in the color, form, or state of aggregation of one or both substances, and which is intended to lead to the identification of the substance examined, or to the ascertainment of its quantity.

All analytical methods require the use of *reagents* and *test-solutions*. These may be defined as substances employed in producing the phenomena above described, or the *reactions* upon which the value of the analysis is based. A list of official reagents and test-solutions is given on pages 1069–1092.

Two kinds of analysis, depending upon the extent of the examination, are in use: 1. Qualitative or qualitive. 2. Quantitative or quantitive.

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[1] The practical pharmacist should be provided with one or all of the following works: Fresenius's "Analysis," Hoffman and Power's "Examination of Medicinal Chemicals," Sutton's "Volumetric Analysis," Allen's "Commercial Organic Analysis," and Trimble's "Practical and Analytical Chemistry."

In *qualitative* analysis, the aim is merely the *identity* or the *quality* of the objects sought for in the substance examined.

In *quantitative* analysis, not only must the substance sought for be identified, but the *quantity* which is present must also be ascertained. Two methods of quantitative analysis are in use, known as the Gravimetric and the Volumetric.

In *gravimetric* quantitative analysis, as its name indicates, the quantities of the constituents are isolated and *weighed*, either separately or in combination.

In *volumetric* quantitative analysis, the constituents are determined, either wholly or in part, in *volume* or *measure*, by dissolving a given weight of a pure salt or body in a definite volume of water or other liquid, thus forming a *standard* or *normal solution*, and using an accurately measured quantity of such a solution to produce a given effect upon the substance which is being tested. The advantages of the volumetric method consist in the ease and rapidity with which the operations may be effected, because liquids can be measured more rapidly than they can be weighed.

It is obvious that volumetric analysis can be used only where some distinctly visible phenomenon occurs in the liquid, which enables the operator to determine accurately a point when the reaction is completed.

In volumetric analysis, accurately made solutions of definite strength are employed. In the Pharmacopœia these are termed test-solutions and volumetric solutions. In general practice the term *normal solution* is used, but, unfortunately, it is applied to several kinds of volumetric solutions, which may be defined as follows:

1. A normal solution is primarily and legitimately one which contains the *molecular weight* of a *univalent* substance, expressed in grammes, dissolved in *one litre* of pure water: thus, the molecular weight of sodium hydrate is 39.96, and hence normal solution of sodium hydrate contains 39.96 grammes of sodium hydrate in 1000 grammes, or 1 litre, of distilled water. When the substance is *bivalent*, the normal solution contains *one-half* of the molecular weight, expressed in grammes, in each litre, as in the volumetric solution of oxalic acid. The molecular weight of oxalic acid is 125.7, and the normal solution is made by dissolving 62.85 grammes of the acid in 1000 C.c. of distilled water. *Decinormal* and *centinormal* solutions are respectively $\frac{1}{10}$ and $\frac{1}{100}$ the strength of normal solutions. Normal solutions of this kind have more than one use, for they are employed in determining the strength and purity of many substances.

2. The term normal solution is, unfortunately, applied also to a liquid of which a given volume (100 C.c.) corresponds with, or exactly saturates, a given weight (1 Gm.) of only *one* substance. These test-liquids are used for technical purposes, and are of use only when employed for the single object for which they were designed: they are intended to indicate the percentage of the pure substance contained in the product examined. They are often employed by manufacturing chemists.

3. Still another kind of normal solution has its strength based on a *special reaction* which takes place when the solution is used for the purpose for which it was intended, the molecular weight or saturating

power having no relation to its strength.[1] Normal solution of potassium permanganate is sometimes made in this way, based on the amount of oxygen that it can transfer to the substance under examination.

Proximate analysis is a term applied to the examination of organic substances with the view of isolating or determining the proximate principles present, as the proximate analysis of cinchona bark in proving the presence or quantity of the quinine, cinchonine, kinic acid, etc.

Ultimate analysis is a term applied to the examination of organic substances to determine their ultimate elements, as in an analysis of quinine to prove the number of atoms of carbon, hydrogen, oxygen, and nitrogen in it.

Proximate and ultimate analyses require individual skill and experience and the application of methods which can be properly mastered only by special study and practical experience under competent instructors. They should never be attempted by the tyro.

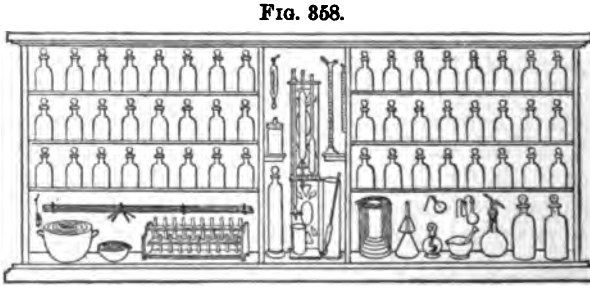
Pharmacopœial testing and volumetric analysis, on the other hand, are directly in the line of the work of the practical pharmacist, and the apparatus required is simple, whilst the operations to be performed are mostly those which he is called upon to perform daily upon a larger scale.

Practice and experience in analytical work will, if conscientiously followed, prove invaluable in training the pharmacist in those habits of accuracy, neatness, and thoroughness which are absolutely essential to the successful pursuit of his profession.

Apparatus used in Testing.

The United States Pharmacopœia very wisely adopted the metric system in all analytical operations requiring definite weights or measures. It is admirably fitted for analytical work, and is used almost universally by chemists throughout the world: hence the apparatus employed is always based on the metric method.

FIG. 358.



Analytical apparatus case.

It is well for the pharmacist to set apart a case, especially in the laboratory, in which to keep this apparatus. It should never be used for dispensing purposes. Fig. 358 represents such a case. which may be made as attractive as the taste of the owner dictates.

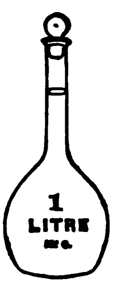
[1] It is greatly to be desired that these last two solutions shall receive some other and appropriate names, and that hereafter the term "normal solution" shall have but one signification.

Graduated Flasks are needed for making standard and normal solutions. These should be accurately stoppered, and the mark on the neck should extend all the way around, and be in the narrowest part. Litre, half-litre, and quarter-litre flasks are all useful (see Fig. 359).

Graduated Jars.—A tall, cylindrical, glass-stoppered jar, graduated into one hundred or one thousand equal parts, is of great service in making test-solutions in smaller quantities (see Fig. 360).

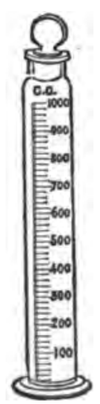
The Burette is indispensable in volumetric testing. It is a graduated glass tube, about one-half inch (12.5 mm.) in diameter and twenty inches (50.8 cm.) in length, having its lower end drawn to a narrow orifice, and the other slightly flared to facilitate the pouring in of the test-liquid: to the lower extremity is attached a piece of rubber tubing, the other end of the tubing being armed with a short piece of glass tube having a capillary orifice. The graduations on the tube are extended to one hundred parts or more, each part being subdivided into five or ten equal parts (see Fig. 361). The rubber tube is closed with a spring pinchcock, the form shown in Fig. 173 being preferred. Fig. 362 represents a convenient holder for the burette whilst in use: the latter may be adjusted to any height to accommodate a large or a small beaker. For test solutions that are decomposed by organic substances, like solution of potassium permanganate, the rubber tube is

FIG. 359.



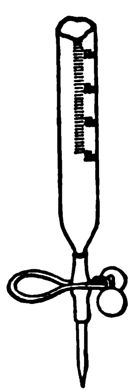
Litre flask.

FIG. 360.



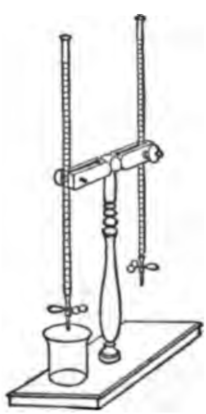
Graduated jar.

FIG. 361.



Burette (enlarged view of end).

FIG. 362.



Burette-holder in use.

unsuitable, and *all glass* burettes must be used: these are closed with a small glass stopcock. To facilitate the reading of the divisions on the burette, Erdmann's float is employed (see Fig. 363): this is an elongated glass bulb, of slightly less diameter than the burette, loaded at one end with mercury, and having a little glass hook at the top to facilitate its being lifted out with a bent wire: a line is scratched on the bulb around the middle, and it is floated in the liquid in the burette. The actual height of the liquid is a matter of indifference, because the reading is made by comparing the line on the float with that on the burette. With practice, excellent work may be performed without the use of the float, by adopting the habit of always reading off where the lowest point of the

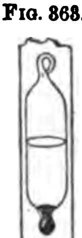
meniscus touches the graduated mark. If the operator is compelled to work in a poor light, the reading of the line may be facilitated by placing a small card, having its lower half blackened, just behind the burette in such a position that the straight line of division between the black and the white portion is very slightly below the surface of the liquid in the burette.

Pipettes may be used for qualitative testing or in small operations. These are intended to be filled by sucking into the graduated tube the quantity of liquid desired: it is retained there by pressing the moistened forefinger on the upper orifice; of course upon raising the finger and applying it again the desired quantity may be made to flow out (see Fig. 364).

The greater part of the apparatus used in such analytical work as the pharmacist is likely to be called upon to perform has been already described in Part I. and elsewhere, and the operations of making solutions, filtration, precipitation, etc., are familiar ones. Glass funnels, beakers, test-tubes, stirring-rods, porcelain capsules, crucibles, reagent and test-solution bottles, etc., will be required.

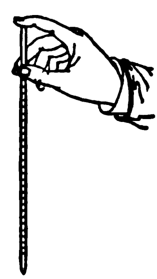
The amber-glass reagent bottles made by Whitall, Tatum & Co., of Philadelphia (see Fig. 365), are well adapted for the purpose of containing the test-liquids. The bottles hold about four fluidounces, and the

FIG. 363.



Erdmann's float.

FIG. 364.



Use of the pipette.

FIG. 365.

Reagent bottle.

labels are blown in the glass, the surface of the letters being ground off so that they can be read distinctly. Paper labels are not well adapted for test-liquids, because they are soon destroyed by the corrosive action of acid vapors or the ink-marks are bleached out.

REAGENTS.

I.—PRELIMINARY REMARKS.

Official Substances as Reagents.—Some official substances (chemicals, chemical solutions, etc.) are sufficiently pure to be used as reagents, if they comply with the tests of purity prescribed by the Pharmacopœia. In the case of others, the presence of certain impurities, though immaterial for their use as medicines, renders their employment as reagents unsuitable. Whenever a greater degree of purity is required than is provided for by the text of the Pharmacopœia, it will be specially mentioned in the following lists.

Abbreviations and Signs Used:

T.S. = Test-solution.

V.S. = Volumetric solution.

$\frac{N}{1}$ = Normal (see under "Volumetric Solutions" in List III.).

$\frac{N}{2}$ = Seminormal; $\frac{N}{10}$ = Decinormal; $\frac{N}{100}$ = Centinormal.

$\frac{2}{N}$ = Double-normal (sometimes written: 2 N).

⋆ (asterisk) *in front* of a figure denotes that the quantity or value expressed by the figure is approximate. In the case of a volumetric solution, for instance, ⋆25 C.c. means "about 25 C.c.," and this is to be interpreted as standing for "24.5 to 25.5 C.c.," the allowable variation in such cases being two per cent. either way. In the text of the Pharmacopœia, this is expressed by saying "about 25 C.c.," or "about 16 per cent. of iron," etc.

Keeping of Reagents.—Reagents should be kept in bottles made of glass free from lead and arsenic, and proof against corrosion by acids and alkalies, preferably in those made of Bohemian glass.

The bottles should be closed by well-ground glass stoppers. Stoppers of bottles containing alkali hydrates, ammonium sulphide, ammonia water, tannic acid, and other substances rapidly attacking ground glass surfaces, should be lubricated with a thin film of petrolatum.

Reagents easily affected by light, such as hydrogen sulphide T.S., ammonium sulphide T.S., chlorine water, etc., should be kept in bottles made of dark amber-colored glass.

Note.—As some of the following test-solutions are in certain cases directed in definite quantities in lieu of the regular volumetric solutions, it is important that they should always be prepared of the *exact strength prescribed.*

II.—LIST OF REAGENTS AND TEST-SOLUTIONS.

Note.—The reagents are arranged in alphabetical order. The test-solutions are usually mentioned in connection with the principal chemical or other substance from which they are prepared. The volumetric solutions will be found in List III. (Nos. 116–135).

Whenever *water* is required or mentioned as a solvent in the tests given in the Pharmacopœia, or in the preparation of any reagent, it is understood that *distilled water* shall be used.

1. **Absolute Alcohol.**—Ethyl alcohol, $C_2H_5OH = 45.9$.—Use the official absolute alcohol [*Alcohol Absolutum*].

2. **Acetic Acid.**—$HC_2H_3O_2 = 59.86$.—Use the official acetic acid [*Acidum Aceticum*].

3. **Albumen Test-Solution.**—Carefully separate the white of a hen's egg from the yolk, shake it thoroughly with 100 C.c. of water, and filter. This solution should be freshly made when required.

4. **Aluminum.**—Metallic aluminum, $Al = 27.04$, in the form of foil, wire, or ribbon. It should be tested for arsenic by Fleitmann's method (see below, No. 13), when no color should be imparted to the silver nitrate within two hours.

5. Ammonia Water.—$NH_3 = 17.01$.—Use the official ammonia water [*Aqua Ammoniæ*].

6. Ammonium Carbonate Test-Solution.—Dissolve 10 Gm. of ammonium carbonate, $NH_4HCO_3NH_4NH_2CO_2 - 156.77$ [*Ammonii Carbonas*, U. S. P.], in a mixture of 10 C.c. of ammonia water and 40 C.c. of water.

For detecting arsenic sulphide in presence of antimony sulphide, the addition of ammonia water is omitted, and 10 Gm. of the salt are dissolved in a sufficient quantity of water to make 100 C.c.

7. Ammonium Chloride Test-Solution.—Dissolve 10 Gm. of ammonium chloride, $NH_4Cl - 53.38$ [*Ammonii Chloridum*, U. S. P.], in enough water to make 100 C.c.

8. Ammonium Molybdate Test-Solution.—Dissolve 1 Gm. of finely powdered ammonium molybdate, $(NH_4)_2MoO_4 = 195.76$, in 6.7 C.c. of hot water, using a little ammonia water, if necessary, to effect solution. Then gradually pour the liquid into a mixture of 8.8 C.c. of nitric acid (sp. gr. 1.414) and 3.4 C.c. of water. Preserve the test-solution in the dark, and, if a sediment should form in it after some days, carefully decant the clear solution from it.

9. Ammonium Oxalate Test-Solution.—Dissolve 4 Gm. of pure, crystallized ammonium oxalate, $(NH_4)_2C_2O_4 + H_2O = 141.76$, in enough water to make 100 C.c. Or, dissolve 4 Gm. of pure oxalic acid (see below, No. 121) in 100 C.c. of water, add 20 C.c. of ammonia water, boil to expel excess of ammonia, and bring the volume to 113 C.c.

On evaporating a portion of the test-solution, and igniting the residue, it should be completely volatilized (absence of *fixed impurities*). The test-solution should not be rendered turbid by hydrogen sulphide T.S., nor by ammonium sulphide T.S. (absence of *metals*). The precipitate produced in it by silver nitrate T.S., or by barium chloride T.S., should dissolve without residue upon addition of nitric acid (absence of *chloride*, and *sulphate*, respectively).

10. Ammonium Phosphate Test-Solution.—Dissolve 1 Gm. of ammonium phosphate, $(NH_4)_2HPO_4 = 131.82$, together with 2 C.c. of ammonia water, in enough water to make 100 C.c. This solution does not keep well. It should be freshly made when required, or frequently renewed.

11. Ammonium Sulphide Test-Solution.—Saturate 8 parts of pure ammonia water with pure, washed hydrogen sulphide, and add to the solution (which now contains ammonium sulphhydrate, $NH_4HS = 50.99$) 2 parts of ammonia water, which converts the greater portion of the ammonium sulphhydrate into ammonium sulphide, $(NH_4)_2S = 68.0$. The solution should be perfectly clear and colorless, and, on being evaporated, leave no residue. It should not be rendered turbid either by magnesium sulphate T.S. (absence of *free ammonia*), or by calcium chloride T.S. (absence of *ammonium carbonate*). It should be protected against air and light by being kept in small, dark amber-colored bottles, in a dark place. As soon as a notable deposit of sulphur has made its appearance in the solution, it should be rejected.

Ammonium polysulphide test-solution is occasionally required. This is a yellow liquid, prepared by dissolving a small quantity of pure sulphur in the preceding, colorless ammonium sulphide test-solution.

12. Arsenic Test, Bettendorff's.—To a small quantity of the liquid to be tested, which should contain much pure concentrated hydrochloric acid or should be a solution of the substance to be tested in pure, concentrated hydrochloric acid, add an equal volume of a saturated solution of freshly prepared stannous chloride in pure, concentrated hydrochloric acid, together with a small piece of pure tin-foil. The presence of arsenic is revealed by the production of a brown color or brown precipitate, the appearance of which is hastened by a gentle heat (see Stannous Chloride, No. 108).

13. Arsenic Test, Fleitmann's.—Into a test-tube of at least 15 Cm. in length, and 15 to 18 Mm. in diameter, place a single, solid piece of zinc (see below, No. 115), weighing about 1 to 1.25 Gm., and add about 5 C.c. of potassium hydrate T.S. [*Liquor Potassæ*, U. S. P.], both ingredients having previously been proven free from arsenic by having been subjected, *alone*, to the test about to be described, during at least two hours, with negative result. Now add the liquid to be tested, which must not contain any free acid, nor very materially increase the volume of the contents of the test-tube. Immediately secure over the mouth of the test-tube a previously prepared cap made of three thicknesses of pure filter paper free from dust, and apply to the upper filter paper a drop of a saturated, aqueous solution of silver nitrate acidulated with nitric acid (see Silver Nitrate T.S., No. 96). Then place the tube at once, upright, into a box containing sand heated to about 90° C. (194° F.),

and fitted with a cover, so as to exclude light and dust, and permit the reaction to proceed for such a time as may be specially prescribed in each case. The presence of arsenic (but not of antimony) is revealed by the production, upon the moistened paper cap, of a brown or black stain. In absence of arsenic, if the test has been carefully conducted, the spot will remain colorless.

In place of zinc, metallic aluminum, best in form of wire, cut into small pieces, may be employed (*Gatehouse's* modification). The method of testing, and the results, are the same as in Fleitmann's test.

14. **Arsenic Test, Gutzeit's.**—Into a test-tube of at least 15 Cm. in length, and 15 to 18 Mm. in diameter, place a single, solid piece of zinc (see below, No. 115), weighing about 1 to 1.25 Gm., and add about 5 C.c. of a mixture, previously prepared and kept in readiness for this purpose, of 10 C.c. of pure sulphuric acid of sp. gr. 1.835, and 190 C.c. of water, the ingredients having previously been proven free from arsenic by having been subjected, *alone*, to the test about to be described, during at least two hours, with negative result. Now add the liquid to be tested, which should not be alkaline, nor exceed 1 C.c. About 1 Cm. below the open end of the test-tube insert a loose plug, about 1 Cm. long, of glass-wool or cotton, which has been moistened with 0.5 C.c. of lead acetate T.S. Then secure over the mouth a cap made of three thicknesses of clean filter paper, and apply to the upper one a drop of a saturated, aqueous solution of silver nitrate, acidulated with nitric acid (see Silver Nitrate T.S., No. 96). Place the tube into a box to exclude light, and let the reaction proceed as long as may be prescribed in each case. The presence of arsenic is shown by the production, upon the moistened paper cap, of a bright yellow stain which becomes black or brown by application of water. Antimony colors the spot black or brown at once without showing a yellow color while dry. In this case, traces of arsenic may be overlooked; it is therefore advisable to subject a fresh portion of the specimen to Fleitmann's test (see No. 13), which responds only to arsenic. If the plug moistened with lead acetate T.S. be strongly colored, so that doubt exists whether the coloration be due to metallic silver reduced by arsenic, or to silver sulphide, produced by an escape of H_2S through the plug, moisten the silver stain with diluted nitric acid, which will dissolve the metallic silver reduced by arsenic, but will not affect the black silver sulphide. Or else, put on a new cap of filtering paper, moistened with a drop of lead acetate T.S. If this remain colorless, sulphide is absent.

15. **Barium Carbonate.**—Pure barium carbonate, $BaCO_3 = 196.75$, prepared by dissolving 12 parts of pure, crystallized barium chloride in 20 parts of boiling water, then adding a solution of 5 parts of ammonium carbonate in 10 parts of boiling water, and afterwards 5 parts of ammonia water; finally washing the precipitate thoroughly and drying it.

16. **Barium Chloride Test-Solution.**—Prepared from pure barium chloride, $BaCl_2 + 2H_2O = 243.56$. The aqueous solution of the salt should be perfectly neutral, and should not yield a precipitate with hydrogen sulphide T.S. or ammonium sulphide T.S. (absence of *metals*, etc.). The aqueous solution, after being precipitated by diluted sulphuric acid in slight excess, yields a filtrate which should not leave any permanent residue when evaporated and heated on platinum-foil (absence of *other fixed bases* and *salts*). Diluted alcohol, after remaining in contact with it for several hours, should, upon ignition, show a pure yellowish-green colored flame, without red streaks (absence of *traces of strontium*). To prepare the *test-solution*, dissolve 12.2 Gm. of the salt in enough water to make 100 C.c. (This solution is of normal strength $= \frac{N}{1}$ V.S., so as to permit of its use for volumetric purposes also.)

17. **Barium Hydrate Test-Solution.**—A saturated solution of barium hydrate [barium hydroxide, $Ba(OH)_2 = 170.82$] in water. This solution rapidly absorbs carbon dioxide from the air. It is preferably prepared freshly as wanted.

18. **Barium Nitrate Test-Solution.**—Prepared from pure barium nitrate, $Ba(NO_3)_2 = 260.68$. This salt should respond to the same tests as barium chloride (see No. 16). In addition, its aqueous solution, slightly acidulated with nitric acid, should not be rendered turbid by silver nitrate T.S. (absence of *chloride*). To prepare the *test-solution*, dissolve 1 Gm. of the salt in water to make 15.8 C.c. (This solution is of half normal strength $= \frac{N}{2}$ V.S., so as to permit of its use for volumetric purposes also.)

19. **Benzin, or Petroleum Ether.**—Use the official benzin [*Benzinum*].

20. **Benzol or Benzene.**—Benzol, $C_6H_6 = 77.82$, is a colorless, transparent liquid of a peculiar, aromatic odor, of a sp. gr. of 0.8846 at 15° C. (59° F.), congealing at 0° C. (32° F.), and boiling at 80.87° C. (176.7° F.). It is insoluble in water, but

soluble in 4 parts of alcohol, and in ether. In concentrated sulphuric acid it should dissolve without producing a color. On shaking 2 C.c. of benzol with 0.5 C.c. of sulphuric acid and 1 drop of fuming nitric acid, no green or blue tint should be produced (absence of *thiophene*).

21. **Brazil Wood Test-Solution.**—See under *Indicators* (No. 49).

22. **Bromine Water** (Bromine Test-Solution), Br = 79.76.—An aqueous solution of bromine [*Bromum*, U. S. P.], prepared by dissolving 1 C.c. of bromine in enough water to make 100 C.c.

23. **Calcium Chloride Test-Solution.**—Dissolve 10.925 Gm. of crystallized calcium chloride, $CaCl_2 + 6H_2O = 218.41$, in enough water to make 100 C.c. (This solution is of normal strength $= \frac{N}{1}$ V.S., so as to permit of its use for volumetric purposes also.)

24. **Calcium Hydrate Test-Solution** (Lime Water), $Ca(OH)_2 = 73.83$.—Use the official lime water [*Liquor Calcis*].

25. **Calcium Sulphate Test-Solution.**—Introduce transparent crystals of native gypsum (selenite), $CaSO_4 + 2H_2O = 171.65$, into a flask filled with water, and decant the clear, saturated solution when required. One part of gypsum requires, at 15° C. (59° F.), 398 parts of water for solution.

26. **Carbon Disulphide.**—Use the official carbon disulphide [*Carbonei Disulphidum*].

27. **Chlorine Water** (Chlorine Test-Solution), Cl = 35.37.—Use the official chlorine water [*Aqua Chlori*]. Since it rapidly deteriorates by keeping, it should be frequently renewed, or freshly prepared when required.

28. **Chloroform**, $CHCl_3 = 119.08$.—Use the official chloroform [*Chloroformum*].

29. **Cobaltous Nitrate Test-Solution.**—$Co(NO_3)_2 + 6H_2O = 290.14$. The crystallized, commercial salt is sufficiently pure, if, after it is dissolved in water, and the cobalt completely precipitated by ammonium sulphide T.S., the filtrate leaves no residue on evaporation. To make the *test-solution*, dissolve 1 Gm. of the salt in 10 C.c. of water.

30. **Cochineal Test-Solution.**—See under *Indicators* (No. 50).

31. **Copper** (Metallic Copper), Cu = 63.18, in form of wire, foil, or turnings. The commercial article, brightened, if necessary, by scouring with diluted hydrochloric acid, is suitable for all purposes except testing for arsenic. If required for this purpose, the absence of arsenic must first be proven. A small portion (about 0.5 Gm.) of the copper is to be dissolved in hot, concentrated sulphuric acid, and this solution subjected to Gutzeit's test (see No. 14). No color should be imparted to the silver nitrate within two hours (absence of *arsenic*).

32. **Cupric Ammonium Sulphate Test-Solution.**—A solution of cupri-tetrammonium sulphate, $Cu(NH_3)_4SO_4 + H_2O = 245.0$. To copper sulphate T.S. add ammonia water, until the precipitate first formed is nearly, but not completely, redissolved; then filter. This solution is apt to decompose on keeping. It should be made freshly when required.

33. **Cupric Sulphate Test-Solution.**—Dissolve 10 Gm. of cupric sulphate, $CuSO_4 + 5H_2O = 248.8$ [*Cupri Sulphas*, U. S. P.], in enough water to make 100 C.c.

34. **Cupric Tartrate Test-Solution.**—See below, under Volumetric Solutions, No. 117.

35. **Corallin Test-Solution.**—See under *Indicators* (No. 51).

36. **Diphenylamine, and Diphenylamine Test-Solution.**—See under *Indicators* (No. 52).

37. **Eosin Test-Solution.**—See under *Indicators* (No. 53).

38. **Ether.**—Use the official ether [*Æther*]. It should be strictly neutral to litmus paper.

39. **Ferric Ammonium Sulphate Test-Solution.**—Dissolve 10 Gm. of ferric ammonium sulphate [*Ferri et Ammonii Sulphas*, U. S. P.] in enough water to make 100 C.c.

40. **Ferric Chloride Test-Solution.**—Dissolve 10 Gm. of ferric chloride, $Fe_2Cl_6 + 12H_2O = 539.50$ [*Ferri Chloridum*, U. S. P.], in enough water to make 100 C.c.

41. **Ferrous Sulphate Test-Solution.**—Dissolve a clear crystal of ferrous sulphate, $FeSO_4 + 7H_2O = 277.42$ [*Ferri Sulphas*, U. S. P.], in about 10 parts of water previously boiled to expel air. This solution should be freshly prepared immediately before use.

42. **Ferrous Sulphide**, FeS = 87.86.—A heavy solid, in form of black or brownish-black irregular masses, or fused into sticks, soluble in sulphuric or hydrochloric acid with copious evolution of hydrogen sulphide. On dissolving 2 Gm. of ferrous sulphide in pure nitro-hydrochloric acid diluted with a little water, evaporating the

solution to dryness, and testing the residue for arsenic by Gutzeit's method (see No. 14), no color should be imparted to the silver nitrate within two hours.

43. **Fluorescein Test-Solution.**—See under *Indicators* (No. 54).

44. **Gelatin Test-Solution.**—Dissolve 1 Gm. of isinglass [*Ichthyocolla*, U. S. P.] in 50 C.c. of water, by the aid of a gentle heat, and filter if necessary. This solution should be freshly made when wanted for use.

45. **Gold Chloride Test-Solution.**—The commercial chloride of gold, usually prepared by dissolving gold in nitro-hydrochloric acid and carefully evaporating to dryness, mostly consists of aurochloric acid, $HAuCl_4 + 2H_2O = 375.1$, which is converted into neutral auric chloride, $AuCl_3 = 302.81$, by fusing it at a temperature not exceeding 150° C. (302° F.), moistening the residue (now consisting of auric and aurous chloride) with enough hot water to produce a syrupy liquid (whereby the aurous chloride is decomposed into auric chloride and metallic gold), and then pouring off the clear liquid from the precipitate. To prepare the *test-solution*, dissolve the liquid finally obtained in the before-mentioned process in 20 volumes of water. Or, dissolve 1 Gm. of dry auric chloride in 30 C.c. of water.

46. **Hydrochloric Acid, Pure, for Tests, $HCl = 36.37$.**—In addition to the tests prescribed for this acid in the text of the Pharmacopœia, it is required to conform to the following more rigorous tests, before it can be employed as a reagent: The addition of 1 C.c. of barium chloride T.S. to 1 C.c. of the acid diluted with 9 C.c. of water should cause no turbidity within twenty-four hours (absence of *sulphuric acid*). A crystal of diphenylamine dropped into the acid should not turn blue (absence of *free chlorine*). On substituting it for sulphuric acid in Gutzeit's test, as described under No. 14, no color should be imparted to the silver nitrate within two hours (absence of *arsenic* or *antimony*).

47. **Hydrogen Sulphide, $H_2S = 33.98$.**—A gas generated by treating ferrous sulphide with diluted sulphuric acid, and washing the gas by passing it through water.

48. **Hydrogen Sulphide Test-Solution, or Hydrosulphuric Acid, $H_2S = 33.98$.**—A saturated, aqueous solution of hydrogen sulphide. To prepare about 1 liter of the solution, treat 20 Gm. of ferrous sulphide, in a suitable apparatus, with a mixture of 20 C.c. of pure sulphuric acid, sp. gr. 1.835, and 250 C.c. of water, pass the gas through a wash-bottle containing a small quantity of water, and conduct it into a bottle of the capacity of about 1½ liters, containing 1 liter of water. When the gas is no longer absorbed, transfer the solution to small, dark amber-colored bottles, to be filled nearly to the top, pass a stream of hydrogen sulphide for a few minutes through each, and then at once stopper them tightly, and preserve them afterwards in a cool and dark place. Before putting them aside, introduce into one of these bottles a few drops of pure hydrochloric acid, and keep it in a warm place during twenty-four hours, after which time no precipitate should be found in it (absence of *arsenic*). Before any of the solution is used, it should be ascertained that it retains a strong odor of hydrogen sulphide, and that, when it is added to an equal volume of ferric chloride T.S., a copious precipitate of sulphur is formed at once.

Indicators for Acidimetry, Alkalimetry, etc.

(Nos. 49–59.)

NOTE.—Each test-solution used as *indicator* should be examined as soon as prepared, and afterwards from time to time, as to its neutrality. If necessary, it should be brought, by the cautious addition of diluted sulphuric acid, or of a dilute solution of an alkali, to such a point that, when a few drops of it are added to 25 C.c. of water, a single drop of a centinormal acid or alkali V.S., respectively, will distinctly develop the corresponding tints.

Since many of the colored test-solutions are injured by exposure to light, it is best to preserve them in dark amber-colored vials. Papers prepared with them should be kept in dark bottles or paper boxes.

49. **Brazil-Wood Test-Solution.**—Boil 50 Gm. of finely cut Brazil-wood [the heart-wood of *Peltophorum dubium* (Sprengel) Britton, nat. ord. *Leguminosæ*] with 100 C.c. of water during half an hour, replacing the water from time to time. Allow the mixture to cool, strain, wash the contents of the strainer with water until 100 C.c. of strained liquid are obtained, add 25 C.c. of alcohol, and filter. This solution turns purplish-red with alkalies, and yellow with acids.

50. **Cochineal Test-Solution.**—Macerate 1 Gm. of unbroken cochineal [*Coccus*, U. S. P.] during four days, with 20 C.c. of alcohol and 60 C.c. of water. Then filter. The color of this test-solution turns violet with alkalies, and yellowish-red with acids. As an indicator it is used chiefly when ammonia or alkaline earths are present.

51. Corallin Test-Solution.—Dissolve 1 Gm. of corallin (a coloring matter derived from coal-tar, and containing rosolic and pararosolic acids) in 10 C.c. of alcohol and enough water to make 100 C.c.

52. Diphenylamine, $(C_6H_5)_2NH$ — 168.65, is in form of grayish-white or colorless crystals, of a peculiar, aromatic odor, melting at 54° C. (129.2° F.), slightly soluble in water, more soluble in acids. It is used either in the dry state, or in solution in dilute sulphuric acid, as a test for nitric acid (in sulphuric acid, water, etc.), or for chlorine (in hydrochloric acid). To test a solution for the presence of nitric acid, a small portion of it is mixed with 1 or 2 drops of diphenylamine T.S., and then concentrated sulphuric acid, *free from nitrose*, is poured in so as to form a layer beneath the solution. The presence of nitric acid is shown by a deep blue color at the zone of contact.

Diphenylamine test-solution is prepared by dissolving 0.1 Gm. of diphenylamine in 50 C.c. of diluted sulphuric acid. The solution should be colorless.

53. Eosin Test-Solution.—Dissolve 1 Gm. of commercial "yellowish" eosin $[K_2C_{20}H_6Br_4O_5]$ in 80 C.c. of water. This solution is red by transmitted light, and shows a strong green fluorescence by reflected light. Acids destroy the fluorescence, and alkalies restore it.

54. Fluorescein Test-Solution.—Agitate 1 Gm. of fluorescein $[C_{20}H_{12}O_5]$ with 100 C.c. of diluted alcohol, until the latter is saturated; then filter. This solution shows a strong green fluorescence, by reflected light, in the presence of the least excess of an alkali.

55. Litmus Paper and Test-Solution.—Exhaust coarsely powdered litmus with boiling alcohol (which removes a peculiar, red coloring matter, erythrolitmin), and digest the residue with about an equal weight of cold water, so as to dissolve the excess of alkali present. The blue solution thus obtained, after being acidulated, may be used to make *red litmus paper*. Finally extract the residue with about 5 times its weight of boiling water, and filter. Preserve the filtrate, as *test-solution*, in wide-mouthed bottles stoppered with loose plugs of cotton to exclude dust but to admit air.

Litmus Paper, Blue.—Impregnate, with the test-solution just described, strips of white, unsized paper, free from wood-pulp, but not too porous, and dry them by suspending them on strings of clean twine.

Litmus Paper, Red.—Prepare this with the same kind of paper and in the same manner as described in the preceding paragraph. To impregnate the paper, either use the blue solution obtained from litmus, by treating the mass, after extraction by alcohol, with cold water, acidulating the same with just enough hydrochloric acid to impart to it a distinctly red tint; or, use the regular test-solution, after acidulating it in the same manner.

Neither blue nor red litmus paper should have a very intense color.

Preserve the test paper in paper boxes or bottles, so as to exclude dust and acid or ammoniacal vapors.

56. Methyl-Orange Test-Solution.—Dissolve 1 Gm. of methyl-orange [the sodium or ammonium salt of dimethylamidoazobenzolsulphonic acid, $HC_{14}H_{14}N_3SO_3$ = 304.47; also known as helianthin, or tropæolin D, or Poirrier's Orange 3 P] in 1000 C.c. of water. Add to it, carefully, diluted sulphuric acid, in drops, until the liquid turns red and just ceases to be transparent. Then filter.

The solution acquires a yellow color when brought in contact with alkali hydrates, carbonates, or bicarbonates. Carbonic acid does not affect it, but sulphuric, hydrochloric, and other acids change its color to crimson. It is not suited for use with organic acids.

57. Phenolphtalein Test-Solution.—Dissolve 1 Gm. of phenolphtalein $[C_{20}H_{14}O_4]$ in 100 C.c. of diluted alcohol. The solution is colored deep purplish-red by alkali hydrates or carbonates; bicarbonates and most other salts do not produce such color; acids render the reddened solution colorless. It is not suitable as an indicator for ammonia or bicarbonates.

Phenolphtalein Paper is prepared by impregnating white, unsized paper with the test-solution and drying it.

58. Rosolic Acid Test-Solution.—Dissolve 1 Gm. of commercial rosolic acid [chiefly methylaurin, $C_{20}H_{16}O_3$ = 303.28] in 10 C.c. of diluted alcohol, and add enough water to make 100 C.c. The solution turns violet-red with alkalies, yellow with acids. In place of rosolic acid, commercial pæonin (also known as aurin R) [chiefly $C_{19}H_{14}O_3$ = 289.81] may be employed.

59. Turmeric Tincture.—Digest any convenient quantity of ground curcuma root [from *Curcuma longa* Linné, nat. ord. *Scitamineæ*] repeatedly with small quantities

of water, and throw this liquid away. Then digest the dried residue for several days with six times its weight of alcohol, and filter.

Turmeric Paper.—Impregnate white, unsized paper with the tincture, and dry it. The tincture, as well as the paper, turns brown with alkalies, and the yellow color is restored by acids. Boric acid, however, even in presence of hydrochloric acid, turns the color to reddish-brown, and this is changed to bluish-black by ammonia.

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60. **Indigo Test-Solution.**—Place 6 Gm. (3.3 C.c.) of fuming sulphuric acid into a beaker well cooled by immersion in water, and stir into it, very gradually, 1 Gm. of finely powdered Bengal indigo. Set the mixture aside for two days, then pour it into 20 C.c. of water, and decant. Or, dissolve 1 Gm. of commercial indigo-carmine (the sodium or potassium salt of sulphindigotic acid) in 150 C.c. of water.

61. **Iodine Test-Solution.**—For preparing the ordinary test-solution (as a reagent for starch, alcohol by iodoform test, etc.), iodine, $I = 126.53$, fulfilling the requirements of the Pharmacopœia [see *Iodum*, U. S. P.], is sufficiently pure. For this purpose dissolve 1 Gm. of iodine and 3 Gm. of potassium iodide in 50 C.c. of water. For use in volumetric analysis, or in other cases where the ordinary impurities present in official iodine are objectionable, *Purified Iodine* must be employed. See under No. 120.

62. **Iron, Metallic,** $Fe = 55.88$.—Bright and perfectly clean iron in the form of wire, sheet, or filings, according to the uses to be made of it. For making solutions of pure iron salts, fine, thin, bright wire (so-called florists' wire) should be used. For detecting copper, bright pieces of sheet iron or knitting-needles are used; for detecting nitric acid, by reduction to ammonia, iron-filings are preferable.

63. **Lead Acetate Test-Solution.**—Dissolve 10 Gm. of clear, transparent crystals of lead acetate, $Pb(C_2H_3O_2)_2 + 3H_2O = 378.0$ [*Plumbi Acetas*, U. S. P.], free from adhering lead carbonate, in enough water to make 100 C.c. Preserve the solution in well-stoppered bottles.

64. **Basic Lead Acetate Test-Solution.**—Use the official solution of lead subacetate [*Liquor Plumbi Subacetatis*].

65. **Litmus Paper and Test-Solution.**—See under *Indicators* (No. 55).

66. **Magnesia Mixture.**—Dissolve 10 Gm. of magnesium sulphate [*Magnesii Sulphas*, U. S. P.], and 20 Gm. of ammonium chloride [*Ammonii Chloridum*, U. S. P.], in 80 C.c. of water, add 42 C.c. of ammonia water, set the mixture aside for a few days in a well-stoppered vessel, and filter. It should never be used freshly made.

67. **Magnesium Sulphate Test-Solution.**—Dissolve 10 Gm. of magnesium sulphate, $MgSO_4 + 7H_2O = 245.84$ [*Magnesii Sulphas*, U. S. P.], in enough water to make 100 C.c.

68. **Mercuric Chloride Test-Solution.**—Dissolve 5 Gm. of mercuric chloride, $HgCl_2 = 270.54$ [*Hydrargyri Chloridum Corrosivum*, U. S. P.], in enough water to make 100 C.c.

69. **Mercuric Potassium Iodide Test-Solution.**—Use the decinormal mercuric potassium iodide volumetric solution (No. 121).

70. **Alkaline Mercuric Potassium Iodide Test-Solution.** (*Nessler's Solution.*) —Dissolve 5 Gm. of potassium iodide [*Potassii Iodidum*, U. S. P.] in 5 C.c. of hot water, and add to this a hot solution of 2.5 Gm. of mercuric chloride [*Hydrargyri Chloridum Corrosivum*, U. S. P.] in 10 C.c. of water. To the turbid, red mixture add 16 Gm. of potassium hydrate [*Potassa*, U. S. P.], dissolved in 40 C.c. of water, and finally make up the volume to 100 C.c. A surplus of red mercuric iodide deposits on cooling, and may be left in the bottle, the clear solution being decanted as needed.

71. **Mercurous Nitrate Test-Solution,** $Hg_2(NO_3)_2 + 2H_2O = 559.3$.—Into a porcelain capsule put 1 Gm. of pure mercury with 0.5 C.c. of pure nitric acid and 0.5 C.c. of distilled water, and place it for 24 hours into a cool, dark room. Separate and drain the crystals, and dissolve them in 100 C.c. of water. Preserve the solution in a dark amber-colored bottle, into which a small globule of mercury has been placed.

72. **Methyl Alcohol,** $CH_3OH = 31.93$.—For the identification of salicylic acid, the rectified, commercial wood-alcohol, having a specific gravity of about 0.820, is sufficiently pure, if it forms a clear, transparent mixture with an equal volume of distilled water.

73. **Methyl-Orange Test-Solution.**—See under *Indicators* (No. 56).

74. **Nitric Acid, Pure, for Tests,** $HNO_3 = 62.89$.—In addition to the tests prescribed for this acid in the text of the Pharmacopœia, it is required to conform to the

following more rigorous test before it can be used as a reagent: On supersaturating 0.5 C.c. of the acid with pure potassium hydrate T.S., and testing a portion of this solution by Fleitmann's method (see under No. 18), no color should be imparted to the silver nitrate within two hours (absence of *arsenic*).

75. **Fuming Nitric Acid (Red Fuming Nitric Acid).**—The commercial acid will answer, if it is of specific gravity 1.450 or over. It should be carefully kept in glass-stoppered bottles in a cool place.

76. **Oxalic Acid Test-Solution.**—Use the decinormal volumetric solution (No. 123).

77. **Phenolphtalein Test-Solution.**—See under *Indicators* (No. 57).

78. **Picric Acid Test-Solution.**—Dissolve 1 Gm. of pure, distinctly crystalline picric acid (trinitrophenol), $C_6H_2(NO_2)_3OH = 228.57$, in 100 C.c. of water, cool the solution, and filter, if necessary.

79. **Platinic Chloride Test-Solution.**—Heat 1 Gm. of pure platinum, in chips, with 6 C.c. of concentrated hydrochloric acid to 80° C. (186° F.), and very gradually add 1 C.c. of strong nitric acid (sp. gr. 1.414) until very nearly all the platinum is dissolved. Evaporate the solution to dryness on a water-bath, moisten the residue with a few drops of hydrochloric acid, and again evaporate to expel the excess of acid. Dissolve the residue in 20 C.c. of water. The *test-solution* may also be prepared by dissolving 1.7 Gm. of neutral platinic chloride, $PtCl_4 = 335.78$, or 2.6 Gm. of chloroplatinic acid, $H_2PtCl_6 + 6H_2O = 516.28$, in 20 C.c. of water. On evaporating a small portion of the solution to dryness and igniting the residue, pure, metallic platinum should be left behind, which should yield nothing soluble to nitric acid.

80. **Potassium Carbonate Test-Solution.**—Dissolve 10 Gm. of anhydrous potassium carbonate, $K_2CO_3 = 137.91$ [prepared from *Potassii Carbonas*, U. S. P.], in enough water to make 100 C.c.

81. **Potassium Chromate Test-Solution.**—Dissolve 1 Gm. of potassium chromate, $K_2CrO_4 = 193.9$, in enough water to make 10 C.c. On adding silver nitrate T.S. to a little of the solution, a red precipitate is produced which should be completely dissolved by nitric acid (absence of *chloride*). Another portion of the solution, mixed with an equal volume of diluted hydrochloric acid, should yield no precipitate with barium chloride T.S. (absence of *sulphate*).

82. **Potassium Cyanide Test-Solution.**—This should be freshly prepared, when required, by dissolving 1 Gm. of potassium cyanide, $KCN = 65.01$ [*Potassii Cyanidum*, U. S. P.], in 4 parts of water.

83. **Potassium Dichromate.**—Use the official potassium bichromate, $K_2Cr_2O_7 = 293.78$ [*Potassii Bichromas*].

84. **Potassium Dichromate Test-Solution.**—Dissolve 10 Gm. of potassium dichromate [*Potassii Bichromas*, U. S. P.] in enough water to make 100 C.c.

85. **Potassium Ferricyanide Test-Solution.**—Dissolve 1 part of potassium ferricyanide, $K_6Fe_2(CN)_{12} = 657.7$, in about 10 parts of water. This solution should be made freshly when required, as it is rapidly decomposed by light. A freshly prepared, aqueous solution, when mixed with some ferric chloride T.S. and diluted with water, should show a brown tint, free from turbidity or a shade of green.

86. **Potassium Ferrocyanide Test-Solution.**—Dissolve 10 Gm. of potassium ferrocyanide, $K_4Fe(CN)_6 + 3H_2O = 421.76$, in enough water to make 100 C.c.

87. **Potassium Hydrate Test-Solution, $KOH = 55.99$.**—Use the official solution of potassa [*Liquor Potassæ*]. For use in Fleitmann's test for arsenic (see above, No. 18), it should have previously been subjected, by itself, to this test, for at least two hours, with negative result (absence of *arsenic*).

88. **Potassium Iodide Test-Solution.**—Dissolve 16.556 Gm. of potassium iodide, $KI = 165.56$ [*Potassii Iodidum*, U. S. P.], in enough water to make 100 C.c., and keep the solution in dark amber-colored, well-stoppered bottles to prevent the formation of iodate. The solution should be frequently renewed, or freshly prepared when required. (This solution is of normal strength $= \frac{N}{1}$ V.S., so as to permit of its use for volumetric and gasometric purposes also.)

89. **Potassium Nitrate.**—The dry salt, $KNO_3 = 100.92$ [*Potassii Nitras*, U. S. P.], responding to the tests of purity required by the Pharmacopœia, particularly to those for absence of chloride and sulphate.

90. **Potassium Permanganate, $KMnO_4 = 157.67$.**—See below, under No. 127.

91. **Potassium Sulphate Test-Solution.**—Dissolve 1 Gm. of potassium sulphate, $K_2SO_4 = 173.88$ [*Potassii Sulphas*, U. S. P.], in enough water to make 115 C.c. (This solution is of decinormal strength $= \frac{N}{10}$ V.S., so as to permit of its use for volu-

metric purposes also, as a substitute for decinormal sulphuric acid, when it is desired not to disturb the neutrality of a liquid.)

92. **Potassium Sulphocyanate Test-Solution,** $KSCN = 96.99$.—Use the decinormal volumetric solution (No. 129).

93. **Pyrogallol.**—Use the official pyrogallol, $C_6H_3(OH)_3 = 125.7$ [*Pyrogallol*].

94. **Rosolic Acid.**—See under *Indicators* (No. 58).

95. **Silver Ammonium Nitrate Test-Solution.**—Dissolve 1 Gm. of silver nitrate [*Argenti Nitras*, U. S. P.] in 20 C.c. of water, and add ammonia water, drop by drop, until the precipitate first produced is almost, but not entirely, redissolved. Filter the solution, and preserve it in dark amber-colored and well-stoppered bottles.

96. **Silver Nitrate Test-Solution,** $AgNO_3 = 169.55$.—For ordinary purposes, use the decinormal volumetric solution (see No. 130). For Gutzeit's test (No. 14), use a saturated solution of silver nitrate in water acidulated with about 1 per cent. of nitric acid.

97. **Silver Sulphate Test-Solution.**—Dissolve 1 Gm. of silver nitrate [*Argenti Nitras*, U. S. P.] in 0.5 C.c. of warm water, and add 1.5 C.c. of pure, concentrated sulphuric acid. On cooling, small transparent crystals of silver sulphate, $Ag_2SO_4 = 311.14$, separate. Carefully pour off the acid liquid, wash the crystals repeatedly, by decantation, with cold water, transfer them to a bottle, add 100 C.c. of water, and agitate so as to produce a saturated solution. For use, decant a sufficient quantity of the latter.

98. **Sodium Acetate Test-Solution.**—Dissolve 10 Gm. of sodium acetate [*Sodii Acetas*, U. S. P.] in enough water to make 100 C.c.

99. **Sodium Bitartrate Test Solution.**—Dissolve 150 Gm. of tartaric acid [*Acidum Tartaricum*, U. S. P.] in 100 C.c. of hot water, and divide the solution into two equal portions. Neutralize one of these accurately with sodium bicarbonate (which will require about 84 Gm. of this salt), and then add the other portion of the acid solution. On cooling, crystals of sodium bitartrate, $NaHC_4H_4O_6 + H_2O = 189.6$, will separate. Remove these, dry them, and keep them in well-stoppered bottles. The *test-solution* is freshly prepared, when required, by dissolving 1 Gm. of the salt in 4 C.c. of water.

100. **Sodium Carbonate.**—The anhydrous salt, $Na_2CO_3 = 105.85$, conforming to the tests of purity prescribed by the Pharmacopœia for *Sodii Carbonas*, but absolutely free from chloride or sulphate.

101. **Sodium Carbonate Test-Solution.**—Dissolve 10.6 Gm. of anhydrous sodium carbonate [No. 100; $Na_2CO_3 = 105.85$] in enough water to make 100 C.c. (This solution is of double normal strength $= \frac{2}{N}$ V.S., so as to permit of its use for volumetric purposes also.)

102. **Sodium Cobaltic Nitrite Test-Solution.**—$Co_2(NO_2)_6 6NaNO_2 + H_2O = 824.82$. Dissolve 4 Gm. of cobaltous nitrate, $Co(NO_3)_2 + 6H_2O = 290.14$, and 10 Gm. of sodium nitrite, $NaNO_2 = 68.93$, in about 50 C.c. of water, add 2 C.c. of acetic acid, and dilute with enough water to make 100 C.c. Should any of the nitrous acid be lost by keeping the solution, a few drops of acetic acid may be added.

103. **Sodium Hydrate Test-Solution,** $NaOH = 39.96$.—Use the official solution of sodium hydrate [*Liquor Sodæ*, U. S. P.].

104. **Sodium Hyposulphite, or Thiosulphate,** $Na_2S_2O_3 + 5H_2O = 247.64$.—See below, under No. 133.

105. **Sodium Nitrite,** $NaNO_2 = 68.93$.—The purest commercial salt, generally in form of pencils, is sufficiently pure.

106. **Sodium Nitroprusside Test-Solution.**—Dissolve 1 part of sodium nitroprusside, $Na_2Fe(NO)(CN)_5 + 2H_2O = 297.67$, in 10 parts of water immediately before using.

107. **Sodium Phosphate Test-Solution.**—Dissolve 10 Gm. of sodium phosphate, $Na_2HPO_4 + 12H_2O = 357.82$ [*Sodii Phosphas*, U. S. P.], in enough water to make 100 C.c.

108. **Stannous Chloride Test-Solution.**—Heat pure tin (see No. 113), in form of foil or granules, with concentrated hydrochloric acid, taking care that the metal be in excess. When the acid is saturated, crystals of stannous chloride, $SnCl_2 + 2H_2O = 225.46$, begin to form. Remove and drain these, dissolve them in 10 parts of water, and preserve the solution in well-stoppered bottles, into each of which a granule of pure tin, or a piece of pure tin-foil, has previously been introduced.

For Bettendorff's test (see above, No. 12), pure concentrated hydrochloric acid is saturated with the freshly prepared crystals.

109. **Starch Test-Solution.**—Mix 1 Gm. of starch with 10 C.c. of cold water, and then add enough boiling water, under constant stirring, to make about 200 C.c.

of a thin, transparent jelly. If it is desired to preserve this test-solution for any length of time, 10 Gm. of zinc chloride, $ZnCl_2 = 135.84$ [*Zinci Chloridum*, U. S. P.], should be added to it, and the solution transferred to small bottles, which should be well stoppered.

110. **Sulphuric Acid, Pure, for Tests,** $H_2SO_4 = 97.82$.—The sulphuric acid of the Pharmacopœia, which may have a specific gravity as low as 1.835, will answer as a reagent for most purposes, provided it is of the required degree of purity. But when "concentrated" sulphuric acid is specially directed in a test, it is intended that the strongest obtainable, pure acid, of a specific gravity of not less than 1.840, be employed.

In addition to the tests prescribed for this acid in the text of the Pharmacopœia, it is required to conform to the following more rigorous tests before it can be employed as a reagent. If 1 C.c. of diphenylamine T.S. (see No. 52) be carefully poured, as a separate layer, upon 5 C.c. of sulphuric acid, contained in a test-tube, no distinct blue color should appear in the zone of contact (absence of *nitric acid*). If a few crystals of pyrogallol [*Pyrogallol*, U. S. P.] be dissolved in about 1 C.c. of pure water, and this solution be carefully poured, as a separate layer, upon some of the sulphuric acid, contained in a test-tube, no brown color should appear in the zone of contact (absence of *nitric* or *nitrous acid*). If a small portion of the acid be subjected to Gutzeit's test, as described under No. 14, no color should be imparted to the silver nitrate within two hours (absence of *arsenic*, etc.).

If it is impossible to obtain any sulphuric acid which will comply with each of these requirements, two kinds of the acid may be kept, one absolutely free from arsenic, for making the arsenic tests; the other free from nitrose (nitric and nitrous acids), for the detection of nitric acid.

111. **Tannic Acid Test-Solution.**—Dissolve 1 Gm. of tannic acid, $HC_{14}H_9O_9 = 321.22$ [*Acidum Tannicum*, U. S. P.], in 1 C.c. of alcohol and enough water to make 10 C.c., immediately before use.

112. **Tartaric Acid Test-Solution.**—Dissolve 1 part of tartaric acid, $H_2C_4H_4O_6 = 149.64$ [*Acidum Tartaricum*, U. S. P.], in 3 parts of water. In the volumetric estimation of soda in potassa, directed by the preceding text of the Pharmacopœia, the tartaric acid test-solution employed for precipitating the potassa should contain 3 Gm. of the acid in 20 C.c. Since fungous growths rapidly destroy the solution of tartaric acid, it should be prepared only as wanted.

113. **Tin.**—Pure metallic tin, $Sn = 118.8$, in form of granules. Its solution in hydrochloric acid should not be precipitated by potassium sulphate T.S. (absence of *lead*), and, when examined by Gutzeit's test, as described under No. 14, it should not cause silver nitrate to become colored within two hours (absence of *arsenic*).

114. **Turmeric Paper and Tincture.**—See under *Indicators* (No. 59).

115. ***Zinc.***—Metallic zinc, $Zn = 65.1$, preferably in the form of thin pencils about 5 Mm. in diameter, prepared by fusing the metal and casting it in moulds, or in form of thin sheets. It should respond to all the tests required by the text of the Pharmacopœia, and in addition, when examined by Gutzeit's test, as described under No. 14, it should not cause the silver nitrate to become colored within two hours (absence of *arsenic*).

116. **Zinc-Iodide-Starch Test-Solution.**—To 100 C.c. of freshly prepared starch test-solution (see No. 109) add 5 Gm. of zinc chloride [*Zinci Chloridum*, U. S. P.] and 3 Gm. of zinc iodide [*Zinci Iodidum*, U. S. P.]. Preserve the colorless solution carefully in small, dark amber-colored and well-stoppered vials.

III.—VOLUMETRIC SOLUTIONS.

Note.—Since most of the volumetric instruments (burettes, pipettes, mixing cylinders, flasks, etc.) which are for sale in the market are graduated to hold the number of cubic centimeters indicated by weighing into them the corresponding number of grammes of water at the temperature of 15.556° C. (60° F.), or 15° C. (59° F.), it is necessary not to deviate materially from this temperature in making the volumetric solutions, or in using them in testing.

All measuring vessels employed for volumetric determinations should agree among themselves in accuracy of graduation.

All bottles in which volumetric solutions are to be kept, as well as the burettes or pipettes in which they are to be measured, should, prior to use, be rinsed with a small quantity of the solution they are to contain.

Volumetric solutions are designated as normal $\left(\frac{N}{1}\right)$ when they contain in 1 liter the molecular weight of the active reagent, expressed in grammes, and reduced to the valency corresponding to one atom of replaceable hydrogen or its equivalent.

Thus, hydrochloric acid, $HCl = 36.37$, having but one H atom replaceable by a basic element, has 36.37 Gm. of HCl in 1000 C.c. of the normal volumetric solution; while sulphuric acid, $H_2SO_4 = 97.82$, having two replaceable H atoms, contains only one-half this number, or 48.91 grammes of H_2SO_4 in 1000 C.c. of its normal solution. Potassium hydrate, $KOH = 55.99$, has but one K to replace one H in acids, hence its normal solution contains 55.99 grammes of KOH in one liter. Two molecules of potassium permanganate, $2KMnO_4 = 315.34$, in oxidation, give off five atoms of O, which are equivalent to ten atoms of H; hence its normal solution should contain $\frac{315.34}{10}$ or 31.534 Gm. in 1 liter.

Solutions containing in 1 liter one-tenth of the quantity of the active reagent in the normal solution are called decinormal $\left(\frac{N}{10}\right)$; those containing one one-hundredth, centinormal $\left(\frac{N}{100}\right)$; those containing twice the amount, double-normal $\left(\frac{2}{N}\right)$; half the amount, seminormal $\left(\frac{N}{2}\right)$.

Solutions containing quantities of the active reagent having *no* simple relation to the molecular weight are called empirical.

In the following list full decimals are given, which, however (especially when delicate balances and weights are not at hand), are in practice frequently abbreviated or rounded off, as, for instance, oxalic acid: 62.85 Gm. to 63 Gm.

When weighing out portions of a substance which is to be tested volumetrically, it will, in most cases, be advantageous to weigh out such a multiple of the amount required as will suffice for several repetitions of the test, and will, at the same time, bring the amount to be weighed out as near to a whole number of grammes as possible.

117. Alkaline Cupric Tartrate Volumetric Solution.

[FEHLING'S SOLUTION.]

A. The Copper Solution.—Dissolve 34.64 Gm. of carefully selected, small crystals of pure cupric sulphate, showing no trace of efflorescence or of adhering moisture, in a sufficient quantity of water to make the solution measure, at or near 15° C. (59° F.), exactly 500 C.c.

Keep this solution in small, well-stoppered bottles.

B. The Rochelle Salt Solution.—Dissolve 173 Gm. of potassium and sodium tartrate [*Potassii et Sodii Tartras*, U. S. P.], and 125 Gm. of potassium hydrate [*Potassa*, U. S. P.], in a sufficient quantity of water to make the solution measure, at or near 15° C. (59° F.), exactly 500 C.c.

Keep the solution in small, rubber-stoppered bottles.

For use, mix exactly equal volumes of the two solutions at the time required.

One Cubic Centimeter of the mixed solution is the equivalent of:

	Gramme.
Cupric Sulphate, crystallized, $CuSO_4 + 5H_2O$	0.03464
Cupric Tartrate, $CuC_4H_4O_6 + 3H_2O$	0.03685
Glucose, anhydrous, $C_6H_{12}O_6$	0.00500

118. Decinormal Bromine Volumetric Solution.

[KOPPESCHAAR'S SOLUTION.]

$Br = 79.76$. 7.976 Gm. in 1 liter.

($NaBrO_3 = 150.64$.—$NaBr = 102.76$.)

($KBrO_3 = 166.67$.—$KBr = 118.79$.)

Dissolve 3 Gm. of sodium bromate and 50 Gm. of sodium bromide (or 3.2 Gm. of potassium bromate and 50 Gm. of potassium bromide) in enough water to make, at or near 15° C. (59° F.), 900 C.c. Of this solution transfer 20 C.c., by means of a pipette, into a bottle having a capacity of about 50 C.c. provided with a glass stopper; add 75 C.c. of water, next 5 C.c. of pure hydrochloric acid, and immediately insert the stopper. Shake the bottle a few times, then remove the stopper just sufficiently to quickly introduce 5 C.c. of potassium iodide T.S., taking care that no bromine vapor escape, and immediately stopper the bottle. Agitate the bottle thoroughly, remove the stopper and rinse it and the neck of the bottle with a little water so that the washings flow into the bottle, and then add from a burette decinormal sodium hyposulphite V.S. until the iodine tint is exactly discharged, using towards the end a few drops of starch T.S. as indicator. Note the number of C.c. of the sodium hyposulphite V.S. thus consumed, and then dilute the bromine solution

so that equal volumes of it and of decinormal sodium hyposulphite V.S. will exactly correspond to each other under the conditions mentioned above.

EXAMPLE.—Assuming that the 20 C.c. of the bromine solution have required 25.2 C.c. of the hyposulphite to completely discharge the iodine tint, the bromine solution must be diluted in the proportion of 20 to 25.2. Thus, if 850 C.c. of it are remaining, they must be diluted with water to measure 1071 C.c.

After the solution is thus diluted, a new trial should be made in the manner above described, in which 25 C.c. of the decinormal sodium hyposulphite V.S. should exactly discharge the tint of the iodine liberated by the bromine set free from the 25 C.c. of bromine solution.

Keep the solution in dark amber-colored glass-stoppered bottles.

One Cubic Centimeter of Decinormal Bromine Solution V.S. is the equivalent of:

	Gramme.
Bromine, Br	0.007976
Carbolic Acid C_6H_5OH	0.001563

The following article is tested with this solution:

	Gm. taken.	C.c. required.	Percent of strength indicated.
Acidum Carbolicum	0.039	24	96 of pure phenol.

119. Normal Hydrochloric Acid.

HCl = 36.37. 36.37 Gm. in 1 liter.

Mix 180 C.c. of hydrochloric acid of specific gravity 1.163 with enough water to make it measure, at or near 15° C. (59° F.), 1000 C.c.

Of this liquid (which is still too concentrated) carefully measure 10 C.c. into a flask, add a few drops of phenolphtalein T.S., and gradually add, from a burette, potassium hydrate V.S., until the red tint produced by it no longer disappears on vigorous shaking, but is not deeper than pale pink. Note the number of C.c. of potassium hydrate V.S. consumed, and then dilute the acid solution so that equal volumes of this and of the potassium hydrate V.S. neutralize each other.

EXAMPLE.—Assuming that 10 C.c. of the acid solution first prepared required exactly 11 C.c. of potassium hydrate V.S., each 10 C.c. of the former must be diluted to 11 C.c., or the whole of the remaining acid solution in the same proportion. Thus, if 950 C.c. are remaining, 95 C.c. of water must be added.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 50 C.c. of the acid solution should require for neutralization exactly 50 C.c. of potassium hydrate V.S. If necessary, a new adjustment should then be made to render the correspondence perfect.

One Cubic Centimeter of Normal Hydrochloric Acid is the equivalent of:

	Gramme.
Hydrochloric Acid, absolute, HCl	0.03637

Note.—Normal hydrochloric acid is in every respect equivalent in neutralizing power to normal sulphuric acid (see below, No. 134), and may be employed, if more convenient, for the same purposes.

120. Decinormal Iodine Volumetric Solution.

I = 126.53. 12.653 Gm.[1] in 1 Liter.

Dissolve 12.653 Gm.[1] of pure iodine (see below) in a solution of 18 Gm. of pure potassium iodide in 300 C.c of water. Then add enough water to make the solution measure, at or near 15° C. (59° F.), exactly 1000 C.c.

Transfer the solution to small, glass-stoppered vials, which should be kept in a dark place.

Preparation of Pure Iodine.—Heat powdered iodine in a porcelain dish placed over a boiling water-bath, and stir it constantly with a glass rod, so that the adhering moisture, together with any cyanogen iodide and most of the iodine bromide and chloride that may be present, may be vaporized. After twenty minutes transfer the iodine

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[1] Instead of taking 12.653 Gm., this figure is often rounded off to 12.65, or even to 12.7. But, whenever a delicate balance is available, the exact amount above directed should be taken.

to a porcelain or other non-metallic mortar, and triturate it with about 5 per cent. of its weight of pure, dry potassium iodide, so as to decompose any remaining iodine bromide and chloride. Then return the mass to the dish, cover it with a clean glass funnel, and heat the dish on a sand-bath. Detach the sublimed, pure iodine, and keep it in well-stoppered bottles, in a cool place.

One Cubic Centimeter of Decinormal Iodine V.S. is the equivalent of:

	Gramme.
Iodine, I	0.012658
Arsenic Trioxide (arsenous acid), As_2O_3	0.004942
Potassium Sulphite, crystallized, $K_2SO_3 + 2H_2O$	0.009692
Sodium Bisulphite, $NaHSO_3$	0.005193
Sodium Hyposulphite (Thiosulphate), crystals, $Na_2S_2O_3 + 5H_2O$	0.024764
Sodium Sulphite, crystallized, $Na_2SO_3 + 7H_2O$	0.012579
Sulphur Dioxide, SO_2	0.003195
Antimony and Potassium Tartrate, cryst., $2K(SbO)C_4H_4O_6 + H_2O$	0.016560

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.
Acidum Arsenosum	0.1	20.0	98.8 of As_2O_3.
Acidum Sulphurosum	2.0	40.0	6.4 of SO_2.
Antimonii et Potassii Tartras (cryst.)	0.332	20.0	100 of pure salt.
Liquor Acidi Arsenosi	24.7 C.c.	49.4 to 50	1 of As_2O_3.
Liquor Potassii Arsenitis	24.7 C.c.	49.4 to 50	1 of As_2O_3.
Sodii Bisulphis	0.26	45.0	90 of pure salt.
Sodii Hyposulphis	0.25	9.9	98.1 of cryst. salt.
Sodii Sulphis	0.63	48.0	96 of cryst. salt.

121. Decinormal Mercuric Potassium Iodide Volumetric Solution.

[MAYER'S SOLUTION.]

$HgI_2 + 2KI = 783.98$. 39.2 Gm. in 1 Liter.

Dissolve 13.546 Gm. of pure mercuric chloride in 600 C.c. of water, and 49.8 Gm. of pure potassium iodide in 100 C.c. of water. Mix the two solutions, and then add enough water to make the mixture measure, at or near 15° C. (59° F.), exactly 1000 C.c.

One Cubic Centimeter of Decinormal Mercuric Potassium Iodide V.S. is the equivalent of:

	Gramme.
Mercuric Potassium Iodide, $HgI_2 + 2KI$	0.0392

122. Normal Oxalic Acid Volumetric Solution.

$H_2C_2O_4 + 2H_2O = 125.7$. 62.85 Gm.[1] in 1 Liter.

Dissolve 62.85 Gm.[1] of pure oxalic acid (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 C.c.

Pure Oxalic Acid, crystallized, is in form of colorless, transparent, clinorhombic crystals which, on ignition upon platinum-foil, leave no residue. One part of it is completely soluble in 14 parts of water at 15° C. (59° F.). Oxalic acid which leaves a residue on ignition, or on solution in water, must be purified, which may be done as follows: To 1 part of the acid add 10 parts of cold water, and shake until the latter is saturated. Filter off the solution from the undissolved crystals, evaporate the filtrate to about three-fourths of its volume, and set it aside so that the fixed salts which it contains may crystallize out. Carefully decant the liquid from the crystals, concentrate it by evaporation, and set it aside to crystallize, stirring occasionally to prevent the formation of large crystals which might enclose moisture. Drain the crystals in a funnel, dry them carefully on blotting paper, and preserve them in well-stoppered bottles.

Note.—Normal oxalic acid volumetric solution is in every respect equivalent in neutralizing power to *normal sulphuric acid* (No. 134), or *normal hydrochloric acid*

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[1] This is frequently rounded off to 63 Gm. when a delicate balance and exact weights are not at hand.

(No. 119), and may be employed, if more convenient, for the same purposes. The solution, however, has a tendency to crystallize at the point of the burette.

One Cubic Centimeter of Normal Oxalic Acid V.S. is the equivalent of:

	Gramme.
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.06285
Ammonia Gas, NH_3	0.01701
Sodium Hydrate, NaOH	0.03996
Potassium Hydrate, KOH	0.05599
Potassium Permanganate, $KMnO_4$	0.03153

123. Decinormal Oxalic Acid Volumetric Solution.

$H_2C_2O_4 + 2H_2O = 125.7.$ 6.285 Gm.[1] in 1 Liter.

Dissolve 6.285 Gm.[1] of pure oxalic acid (see under No. 122) in enough water to make, at or near 15° C. (59° F.), exactly 1000 C.c.

One Cubic Centimeter of Decinormal Oxalic Acid V.S. is the equivalent of:

	Gramme.
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.006285
Ammonia Gas, NH_3	0.001701
Calcium Hydrate, $Ca(OH)_2$	0.003691
Potassium Hydrate, KOH	0.005599
Potassium Permanganate, $KMnO_4$	0.0031534
Sodium Hydrate, NaOH	0.003996

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.
Liquor Calcis	50.0	*20.0	*0.14 of $Ca(OH)_2$.
Potassii Iodidum (alkalinity, K_2CO_3)	1.0	0.05	0.034 of alkali.
Potassii Permanganas	0.1	31.3	98.70 of pure salt.

124. Decinormal Potassium Dichromate Volumetric Solution.

$K_2Cr_2O_7 = 293.78.$ 4.896 Gm.[2] in 1 Liter.

Dissolve 4.896 Gm.[2] of pure potassium dichromate (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 C.c.

Pure Potassium Dichromate for use in volumetric analysis, besides responding to the tests given in the text of the Pharmacopœia (under *Potassii Bichromas*), must conform to the following tests. In a solution of 0.5 Gm. of the salt in 10 C.c. of water rendered acid by 0.5 C.c. of nitric acid, no visible change should be produced either by barium chloride T.S. (absence of *sulphate*), or by silver nitrate T.S. (absence of *chloride*). In a mixture of 10 C.c. of the aqueous solution (1 in 20) with 1 C.c. of ammonia water, no precipitate should be produced by ammonium oxalate T.S. (absence of *calcium*).

When used with phenolphtalein as indicator, to neutralize alkalies, the volumetric solution of potassium dichromate is decinormal when it contains 14.689 Gm. in 1 liter. It is then the exact equivalent of any decinormal acid, corresponding to the amounts of alkalies quoted, for instance, under Decinormal Oxalic Acid V.S. (No. 123).

When used as an oxidizing agent to convert ferrous into ferric salts, or to liberate iodine from potassium iodide, the solution just mentioned (containing 14.689 Gm. in 1 liter) has the effect of a $\frac{3N}{10}$ volumetric solution, and a solution of one-third of this strength, containing 4.896 Gm. in 1 liter, has the value of a decinormal solution, and is the equivalent of equal volumes of decinormal potassium permanganate V.S., or, in the case of iodine liberated from potassium iodide, it is the equivalent of equal volumes of decinormal sodium hyposulphite V.S. For titrating iron in *ferrous* compounds, it is used in the following manner. Introduce the aqueous solution of the

[1] Generally rounded off to 6.3 Gm., when a delicate balance and exact weights are not available.
[2] Generally rounded off to 4.9 Gm., when a delicate balance and exact weights are not available.

ferrous salt into a flask, and, if it is not already acid, render it so with sulphuric acid. Now add, gradually, decinormal potassium dichromate V.S. from a burette, until a drop taken out upon a white surface no longer shows a blue color with a drop of freshly prepared potassium ferricyanide T.S.

Decinormal potassium dichromate V.S. may also be used, in conjunction with potassium iodide (from which it liberates iodine) and sulphuric acid, for adjusting the titer of sodium hyposulphite (thiosulphate) V.S., and, by its means, that of the iodine V.S.

One Cubic Centimeter of Decinormal Potassium Dichromate V.S. is the equivalent of:

	Gramme.
Potassium Dichromate, $K_2Cr_2O_7$	0.0048963
Iron, in ferrous compounds	0.005588
Ferrous Carbonate, $FeCO_3$	0.011573
Ferrous Sulphate, anhydrous, $FeSO_4$	0.015170
Ferrous Sulphate, crystallized, $FeSO_4 + 7H_2O$	0.027742
Ferrous Sulphate, dried, $2FeSO_4 + 3H_2O$	0.017864
Potassium Hydrate, KOH	0.001866
Sodium Hyposulphite (Thiosulphate), $Na_2S_2O_3 + 5H_2O$	0.024764

The following articles may be tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.
Ferri Carbonas Saccharatus	1.16	*15	* 15 of iron.
Ferri Sulphas	1.3871	50	100 of pure salt.
Ferri Sulphas Granulatus	1.3871	50	100 of pure salt.

125. Normal Potassium Hydrate Volumetric Solution.

KOH = 55.99. 55.99 Gm.[1] in 1 Liter.

Dissolve 75 Gm. of potassium hydrate [*Potassa*, U. S. P.] in enough water to make, at or near 15° C. (59° F.), about 1050 C.c., and fill a burette with a portion of this liquid.

Put 0.6285 Gm.[2] of pure oxalic acid (see No. 122) into a flask of the capacity of about 100 C.c., and dissolve it with about 10 C.c. of water. Add a few drops of phenolphtalein T.S., and then carefully add, from the burette, the potassium hydrate solution, frequently agitating the flask, and regulating the flow to drops towards the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of C.c. of the potassium hydrate solution consumed, and then dilute the remainder of the solution so that exactly 10 C.c. of the diluted liquid shall be required to neutralize 0.6285 Gm.[2] of oxalic acid.

EXAMPLE.—Assuming that 8.0 C.c. of the stronger solution of potassium hydrate first prepared had been consumed in the trial, then each 8.0 C.c. must be diluted to 10 C.c., or the whole of the remaining solution in the same proportion. Thus, if 1000 C.c. should be still remaining, this must be diluted with water to 1250 C.c.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 10 C.c. of the diluted solution should exactly neutralize 0.6285 Gm.[2] of oxalic acid. If necessary, a new adjustment should then be made to render the correspondence perfect.

Note.—Solutions of caustic alkalies are very prone to absorb carbon dioxide from the atmosphere, and thereby become liable to occasion errors when used with litmus T.S. or phenolphtalein T.S. as indicator (methyl-orange T.S. is not affected by the presence of carbonic acid). Hence the volumetric solutions should be preserved in small vials provided with well-fitting corks or rubber stoppers, or, better still, they should have tubes filled with a mixture of soda and lime attached to their stoppers, so as to absorb the carbon dioxide and prevent its access to the solution.

In place of potassium hydrate V.S., sodium hydrate V.S. (see No. 132) may be used, in the same manner and in the same quantity. Potassium hydrate V.S., however, is preferable, since it foams less, and attacks glass more slowly and less energetically.

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[1] This figure is frequently rounded off to 56 Gm.

[2] This figure may be rounded off to 0.63 Gm., if a delicate balance and exact weights are not available.

One Cubic Centimeter of Normal Potassium Hydrate V.S. is the equivalent of:

	Gramme.
Potassium Hydrate, KOH	0.05599
Sodium Hydrate, NaOH	0.03996
Ammonia Gas, NH_3	0.01701
Ammonium Chloride, NH_4Cl	0.05338
Acetic Acid, absolute, $HC_2H_3O_2$	0.05986
Citric Acid, crystallized, $H_3C_6H_5O_7 + H_2O$	0 06983
Hydrobromic Acid, absolute, HBr	0.08076
Hydrochloric Acid, absolute, HCl	0.03637
Hydriodic Acid, absolute, HI	0.12753
Hypophosphorous Acid, HPH_2O_2	0.06588
Lactic Acid, absolute, $HC_3H_5O_3$	0.08979
Nitric Acid, absolute, HNO_3	0.06289
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.06285
Phosphoric Acid, H_3PO_4 (to form K_2HPO_4; with phenolphtalein)	0.0489
Phosphoric Acid, H_3PO_4 (to form KH_2PO_4; with methyl-orange)	0.0978
Potassium Dichromate, $K_2Cr_2O_7$	0.14689
Sulphuric Acid, absolute, H_2SO_4	0.04891
Tartaric Acid, crystallized, $H_2C_4H_4O_6$	0.07482

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.	
Acidum Aceticum	6.0	36.0	36	of absolute acid.
Acidum Aceticum Dilutum	24.0	24.0	6	of absolute acid.
Acidum Aceticum Glaciale	3.0	49.5	99	of absolute acid.
Acidum Citricum	3.5	50.0	100	of crystall. acid.
Acidum Hydrobromicum Dilutum	8.08	10.0	10	of absolute acid.
Acidum Hydrochloricum	3.64	31.9	31 9	of absolute acid.
Acidum Hydrochloricum Dilutum	3.64	10.0	10	of absolute acid.
Acidum Hypophosphorosum Dilutum	6.6	*10.0	*10	of absolute acid.
Acidum Lacticum	4.50	37.5	75	of absolute acid.
Acidum Nitricum	3.145	34.0	68	of absolute acid.
Acidum Nitricum Dilutum	6.29	10.0	10	of absolute acid.
Acidum Phosphoricum	0.978	17.0	85	of absolute acid.
Acidum Phosphoricum Dilutum	4.89	10.0	10	of absolute acid.
Acidum Sulphuricum	0.49	9.25	92.5	of absolute acid.
Acidum Sulphuricum Aromaticum	4.89	*18.5	*18.5	of absolute acid.
Acidum Sulphuricum Dilutum	4.89	10.0	10	of absolute acid.
Acidum Tartaricum	3.75	50.0	100	of crystall. acid.
Vinum Album / Vinum Rubrum	50.0	3 0 to 5.2	0.45 to 0.78	of acid assumed to be tartaric.

126. Centinormal Potassium Hydrate Volumetric Solution.

KOH = 55.99. 0.5599 Gm. in 1 Liter.

Dilute 10 C.c. of normal potassium hydrate volumetric solution with enough distilled water to make 1000 C.c.

One Cubic Centimeter of Centinormal Potassium Hydrate V.S. is the equivalent of:

	Gramme.
Potassium Hydrate, KOH	0 0005599
Sulphuric Acid, H_2SO_4	0.0004891
Combined Alkaloids of Nux Vomica[1]	0.00364

[1] Assumed to consist of equal parts of strychnine and brucine.—Centinormal potassium hydrate V.S. (in place of which centinormal sodium hydrate V.S., prepared in the same manner, may be employed) is used in the assay of Extract of Nux Vomica, to neutralize the excess of decinormal sulphuric acid employed.

127. Decinormal Potassium Permanganate Volumetric Solution.

$2KMnO_4 = 315.34.$ 3.1534 Gm.[1] in 1 Liter.

I. Place 3.5 Gm. of pure, crystallized potassium permanganate in a flask, add 1000 C.c. of boiling water, and boil until the crystals are dissolved. Close the flask, and set it aside for two days, so that any suspended matters may deposit. This is the *stronger solution*. Prepare another, *weaker solution*, in the same manner, using 6.6 Gm. of the salt and 2200 C.c. of water, and set this also aside for two days. After the lapse of this time, pour off the clear portion of each solution into separate vessels provided with glass stoppers, and then proceed to test each separately.

Introduce into a flask 10 C.c. of decinormal oxalic acid V.S., add 1 C.c. of pure, concentrated sulphuric acid, and, before this mixture cools, gradually add from a burette small quantities of the weaker permanganate solution, shaking the flask after each addition and reducing the flow to drops towards the end of the operation. When the last drop of the permanganate solution added is no longer decolorized but imparts a pinkish tint to the liquid, note the number of C c. consumed. In the same manner ascertain the titer of the stronger solution, and likewise note down the number of C.c. of the latter consumed. Finally mix the two solutions in such proportions that 50 C.c. of the mixture will exactly correspond to an equal volume of decinormal oxalic acid V.S.

Note.—To obtain the accurate proportions for mixing the two solutions, deduct 10 from the number of C.c. of the weaker solution required to decompose 10 C.c. of decinormal oxalic acid V.S. With this difference multiply the number of C.c. of the stronger solution required for the same purpose. The product shows the number of C.c. of the *stronger solution* needed for the mixture.

Next deduct the number of C.c. of the stronger solution required to decompose 10 C.c. of decinormal oxalic acid V.S. from 10, and with the difference multiply the number of C.c. of the weaker solution required for the same purpose. The product shows the number of C.c. of the *weaker solution* needed for the mixture.

Or, designating by S the number of C c. of the stronger solution, and by W the number of C.c. of the weaker solution required to decompose 10 C.c. of decinormal oxalic acid V.S., the following formula will give the proportions in which the solutions must be mixed:

$$\begin{array}{ccc} \text{Stronger Solution:} & & \text{Weaker Solution:} \\ (W - 10)\,S & + & (10 - S)\,W \end{array}$$

Example.—Assuming that 9 C.c. of the stronger (S) and 10.5 of the weaker (W) solution had been required, then, substituting these values in the above given formula, we obtain:

$$\begin{array}{ll} (10.5 - 10)\,9 & + (10 - 9)\,10.5 \\ \text{or, } 4.5 & + \text{or, } 10.5 \end{array}$$

making 15 C.c. of final solution.

The bulk of the two solutions is now mixed in the same proportion, 450 C.c. of the stronger and 1050 C.c. of the weaker, or 900 C.c. of the stronger and 2100 C.c. of the weaker solution.

After the mixture is thus prepared, a new trial should be made, when 10 C.c. of the solution should exactly decompose 10 C.c. of the decinormal oxalic acid V.S. If necessary, a new adjustment should be made to render the correspondence perfect.

This solution should be kept in small, dark amber-colored and glass-stoppered bottles (or in bottles provided with tubes, especially designed for the purpose). Thus prepared, this solution will hold its titer for months; yet it should be tested occasionally, and, when it is found reduced, the liquid should be brought back to normal strength by the addition of such an amount of the stronger solution as may be determined in the manner above described.

II. When potassium permanganate V.S. is to be prepared for immediate use, this may be done in the following manner. Dissolve 3.5 Gm. of pure, crystallized potassium permanganate in 1000 C.c. of pure water, recently boiled and cooled. Introduce 10 C.c. of decinormal oxalic acid V.S. into a beaker, add 1 C.c. of pure concentrated sulphuric acid, and proceed as directed above for the weaker permanganate solution. Note the number of C.c. of the solution consumed, and then dilute the remainder with pure water recently boiled and cooled, until 50 C.c. will exactly correspond to 50 C.c. of decinormal oxalic acid V.S.

Example.—Assuming that 9.1 C.c. of the permanganate solution first prepared

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[1] This quantity is never directly weighed, but adjusted either by Oxalic Acid or by Iron; in calculations it is often abbreviated.

had been required to produce a permanent pink tint, then every 9.1 C.c. of the solution must be diluted to 10 C.c., or the whole of the remaining solution in the same proportion. A new trial should then be made to verify the agreement.

Note.—Potassium permanganate V.S. thus prepared is liable to deteriorate more readily and quickly than that prepared by the method first given (under I.). It cannot be safely trusted without verification each time it is to be used.

One Cubic Centimeter of Decinormal Potassium Permanganate V.S. is the equivalent of:

	Gramme.
Potassium Permanganate, $KMnO_4$	0.0031534
Barium Dioxide, BaO_2	0.008441
Calcium Hypophosphite, $Ca(PH_2O_2)_2$	0.0021209
Ferric Hypophosphite, $Fe_2(PH_2O_2)_6$	0.0020877
Iron, in ferrous compounds, Fe	0.005588
Ferrous Carbonate, $FeCO_3$	0.011573
Ferrous Oxide, FeO	0.007195
Ferrous Sulphate, anhydrous, $FeSO_4$	0.015170
Ferrous Sulphate, crystals, $FeSO_4 + 7H_2O$	0.027742
Ferrous Sulphate, dried, $2FeSO_4 + 3H_2O$	0.017864
Hydrogen Dioxide, H_2O_2	0.001696
Hypophosphorous Acid, HPH_2O_2	0.001647
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.006285
Oxygen, O	0.000798
Potassium Hypophosphite, KPH_2O_2	0.002598
Sodium Hypophosphite, $NaPH_2O_2 + H_2O$	0.002646

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.	
Acidum Hypophosphorosum Dilutum	0.5	*30.3	*10	of absolute acid.
Aqua Hydrogenii Dioxidi	1.7 C.c.	*30.0	* 3	of H_2O_2.
Barii Dioxidum	0.422	40.0	80	of pure BaO_2.
Calcii Hypophosphis	0.1	47.0	99.68	of pure salt.
Ferri Carbonas Saccharatus	1.16	*15.0	*15	of $FeCO_3$.
Ferri Hypophosphis	0.1	47.0	98.1	of pure salt.
Ferri Sulphas	1.39	50.0	100	of pure salt.
Ferri Sulphas Granulatus	1.39	50.0	100	of pure salt.
Ferrum Reductum	0.056	8.0	80	of iron as metal.
Potassii Hypophosphis	0.1	38.0	98.7	of pure salt.
Sodii Hypophosphis	0.1	37.0	97.9	of pure salt.

128. Centinormal Potassium Permanganate Volumetric Solution.

$2KMnO_4 = 315.34$. 0.31534 Gm. in 1 Liter.

Dilute 10 C.c. of the decinormal potassium permanganate V.S., after having ascertained that it possesses its exact titer, with enough distilled water strictly complying with the tests given in the text of the Pharmacopœia for *Aqua Destillata*, to make 100 C.c.

This solution should be freshly made when required.

One Cubic Centimeter of Centinormal Potassium Permanganate V.S. is the equivalent of:

	Gramme.
Potassium Permanganate, $KMnO_4$	0.00031534
Oxalic Acid, crystallized, $H_2C_2O_4 + 2H_2O$	0.0006285
Oxygen (derived from the permanganate) available for oxidation	0.0000798

129. Decinormal Potassium Sulphocyanate Volumetric Solution.

[Volhard's Solution.]

$KSCN = 96.99$. 9.699 Gm. in 1 Liter.

Dissolve 10 Gm. of crystals of pure potassium sulphocyanate in 1000 C.c. of water.

This solution is yet too concentrated, and has to be adjusted so as to correspond in strength exactly with decinormal silver nitrate V.S. For this purpose, introduce into

a flask 10 C.c. of decinormal silver nitrate V.S. together with 0.5 C.c. of ferric ammonium sulphate T.S. and 5 C.c. of diluted nitric acid. To this mixture add, from a burette, in small portions at a time, the sulphocyanate solution. At first a white precipitate of silver sulphocyanate appears, then every drop falling from the burette is surrounded by a deep brownish-red color of ferric sulphocyanate which disappears on vigorous shaking of the flask as long as any of the silver nitrate remains unchanged. When all the silver has been converted into sulphocyanate, a single additional drop of the potassium sulphocyanate solution produces a brownish-red color which no longer disappears on shaking, but communicates a perceptible pale brownish or reddish tint to the contents of the flask. Note the number of C.c. of the potassium sulphocyanate solution used, and dilute the whole of the remaining solution so that equal volumes of this and of the decinormal silver nitrate V.S. will be required to produce the permanent brownish or reddish tint. (The same depth of pale brownish or reddish tint to which the volumetric solution is adjusted must be attained when the solution is used for volumetric assays.)

After the dilution, a new trial should be made, in which 50 C c. of decinormal silver nitrate V.S., 2.5 C.c. of ferric ammonium sulphate T.S., and 25 C.c. of diluted nitric acid are used, and there should be required exactly 50 C.c. of the sulphocyanate solution to produce the same depth of a permanent pale brownish or reddish tint.

If necessary, a new adjustment should be made, to render the correspondence perfect.

One Cubic Centimeter of Decinormal Potassium Sulphocyanate V.S. is the equivalent of:

	Gramme.
Potassium Sulphocyanate, KSCN	0.009699
Silver, Ag	0.010766
Silver Nitrate, $AgNO_3$	0.016955

The following articles are tested with this solution:

Ferri Iodidum Saccharatum Syrupus Ferri Iodidi	Determined by residual titration with decinormal silver nitrate V.S., and decinormal potassium sulphocyanate V.S.

130. Decinormal Silver Nitrate Volumetric Solution.

$AgNO_3 = 169.55$. 16 955 Gm.[1] in 1 Liter.

Dissolve 16.955 Gm.[1] of pure silver nitrate in enough water to make, at or near 15° C. (59° F.), exactly 1000 C.c.

Keep the solution in small, dark amber-colored, glass-stoppered vials, carefully protected from dust.

Note.—Titration by decinormal silver nitrate V.S. may be managed in various ways, adapted to the special preparation to be tested:

a. In most cases it is directed by the U. S. P. to be used in presence of a small quantity of potassium chromate T.S., which serves to indicate the end of the reaction by the appearance of the red color of silver chromate.

b. In some cases (potassium cyanide, hydrocyanic acid) it is added until the first appearance of a permanent precipitate.

c. It may be used in *all* cases without indicator by observing the exact point when no further precipitate occurs. This may be practised in the case of ferrous iodide, where the addition of potassium chromate would be improper, but it consumes much time in waiting for the precipitate to subside so as to render the liquid sufficiently clear to recognize whether a further precipitate is produced by addition of the silver solution.

d. It may be added in definite amount, known to be in excess of the quantity required, and the excess of the decinormal silver solution measured back by the addition of decinormal potassium sulphocyanate V.S. (residual titration).

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[1] Frequently rounded off to 16.96 Gm., when a delicate balance and exact weights are not available.

One Cubic Centimeter of Decinormal Silver Nitrate V.S. is the equivalent of:

	Gramme.
Silver Nitrate, $AgNO_3$	0.016955
Ammonium Bromide, NH_4Br	0.009777
Ammonium Chloride, NH_4Cl	0.005338
Calcium Bromide, $CaBr_2$	0.0099715
Ferrous Bromide, $FeBr_2$	0.010770
Ferrous Iodide, FeI_2	0.015447
Hydrocyanic Acid, absolute, HCN, with indicator	0.002698
Hydrocyanic Acid, absolute, HCN, to first formation of precipitate	0.005396
Hydriodic Acid, HI	0.012753
Hydrobromic Acid, HBr	0.008076
Lithium Bromide, LiBr	0.008677
Potassium Bromide, KBr	0.011879
Potassium Chloride, KCl	0.00[illegible]440
Potassium Cyanide, KCN, with indicator	0.006501
Potassium Cyanide, KCN, to first formation of precipitate	0.013002
Potassium Iodide, KI	0.016556
Potassium Sulphocyanate, KSCN	0.009699
Sodium Bromide, NaBr	0.010276
Sodium Chloride, NaCl	0.005837
Sodium Iodide, NaI	0.014953
Strontium Bromide, $SrBr_2$ (anhydrous)	0.012341
Strontium Iodide, SrI_2 (anhydrous)	0.017018
Zinc Bromide, $ZnBr_2$	0.011231
Zinc Chloride, $ZnCl_2$	0.006792
Zinc Iodide, ZnI_2	0.015908

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.	
Acidum Hydrocyanicum Dilutum	1.35	10.0	2	of absolute acid.
Ammonii Bromidum	0.3	30.9	99	of pure salt.
Calcii Bromidum	0.25	25.0	99.7	of pure salt.
† Ferri Iodidum Saccharatum	1.55	*20.0	*20	of iodide.
Lithii Bromidum	0.3	35.3	98	of pure salt.
Potassii Bromidum	0.5	42.85	97	of pure salt.
Potassii Cyanidum (to first precip.)	0.65	45.0	90	of pure salt.
Potassii Iodidum	0.5	30.25	99.5	of pure salt.
Sodii Bromidum	0.3	29.8	97.29	of pure salt.
Sodii Chloridum	0.195	33.4	99.9	of pure salt.
Sodii Iodidum	0.5	34.5 to 33.4	*98	of pure salt.
Strontii Bromidum (dry)	0.3	24.6	98	of pure salt.
Strontii Iodidum (dry)	0.3	18.0	98	of pure salt.
Syrupus Acidi Hydriodici	32.0	*25.0	* 1	of HI.
† Syrupus Ferri Iodidi	1.55	*10.0	*10	of FeI_2.
Zinci Bromidum	0.3	26.7	99.95	of pure salt.
Zinci Chloridum	0.3	44.1	99.84	of pure salt.
Zinci Iodidum	0.5	31.0	98.62	of pure salt.

Note.—The articles marked with † are determined by residual titration with decinormal silver nitrate V.S. and decinormal potassium sulphocyanate V.S.

131. Decinormal Sodium Chloride Volumetric Solution.

NaCl = 58.37. 5.837 Gm.[1] in 1 Liter.

Dissolve 5.837 Gm.[1] of pure sodium chloride (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 C.c.

Pure Sodium Chloride may be prepared by passing a current of dry hydrochloric acid gas into a saturated aqueous solution of the purest commercial sodium chloride, separating the crystalline precipitate, and drying it at a temperature sufficiently high to expel all traces of free acid.

In place of this, transparent crystals of pure rock-salt may be employed.

[1] Frequently rounded off to 5.84 Gm., when a delicate balance and exact weights are not available.

One Cubic Centimeter of Decinormal Sodium Chloride V.S. is the equivalent of:

	Gramme.
Sodium Chloride, NaCl	0.005837
Silver, Ag	0.010766
Silver Nitrate, $AgNO_3$	0.016955
Silver Oxide, Ag_2O	0.011564

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.
Argenti Nitras	0.34	20.0	99.97 of silver nitrate.
Argenti Nitras Dilutus	1.0	19.5	88.14 of silver nitrate.
Argenti Nitras Fusus	0.34	19.0	95 of silver nitrate.

132. Normal Sodium Hydrate Volumetric Solution.

NaOH = 39.96. 39.96 Gm.[1] in 1 Liter.

Dissolve 54 Gm. of sodium hydrate (*Soda*, U. S. P.) in enough water to make, at or near 15° C. (59° F.), about 1050 C.c., and fill a burette with a portion of this liquid.

Put 0.6285 Gm.[2] of pure oxalic acid (see under No. 122) into a flask of the capacity of about 100 C.c., and dissolve it with about 10 C.c. of water. Add a few drops of phenolphtalein T.S., and then carefully add, from the burette, the sodium hydrate solution, frequently agitating the flask, and regulating the flow to drops towards the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of C.c. of the sodium hydrate solution consumed, and then dilute the remainder of it so that exactly 10 C.c. of the diluted liquid will be required to neutralize 0.6285 Gm.[2] of oxalic acid.

EXAMPLE.—Assuming that 7.8 C.c. of the stronger solution of sodium hydrate first prepared had been consumed in the trial, then each 7.8 C.c. must be diluted to 10 C.c., or the whole of the remaining solution in the same proportion. Thus, if 980 C.c. should be still remaining, this must be diluted with water to 1258 C.c.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 10 C.c. of the diluted solution should exactly neutralize 0.6285 Gm. of oxalic acid. If necessary, a new adjustment should then be made, to render the correspondence perfect.

Note.—The same precautions should be taken for protecting this solution from the carbon dioxide of the air, as are prescribed for normal potassium hydrate V.S. (see No. 125).

This solution may be employed in place of the normal potassium hydrate V.S., volume for volume.

133. Decinormal Sodium Hyposulphite Volumetric Solution.

$Na_2S_2O_3 + 5H_2O = 247.64$. 24.764 Gm. in 1 Liter.

Dissolve 30 Gm. of selected crystals of sodium hyposulphite (sodium thiosulphate) in enough water to make, at or near 15° C. (59° F.), 1100 C.c. Of this solution transfer 10 C.c. into a flask, add a few drops of starch T.S., and then gradually add, from a burette, decinormal iodine V.S., in small portions at a time, shaking the flask after each addition, and regulating the flow to drops towards the end of the operation. As soon as the color produced by the influx of the iodine solution no longer disappears on shaking, but is not deeper than very pale blue, note the number of C.c. of the iodine solution consumed. Then dilute the sodium hyposulphite solution so that equal volumes of it and of decinormal iodine V.S. will exactly correspond to each other under the conditions mentioned above.

EXAMPLE.—Assuming that 10 C.c. of the stronger sodium hyposulphite solution first prepared had required 10.7 C.c. of decinormal iodine V.S. to produce a faint reaction with starch, the hyposulphite solution must be diluted in the proportion of 10 C.c. to 10.7 C.c., or 1000 C.c. to 1070 C.c.

After the solution is thus diluted, a new trial should be made in the manner above described, in which 50 C.c. of the decinormal sodium hyposulphite V.S. should require exactly 50 C.c. of decinormal iodine V.S. to produce a faint reaction with starch. If necessary, a new adjustment should then be made to render the correspondence perfect.

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[1] Frequently rounded off to 40 Gm.

[2] This may be rounded off to 0.63 Gm., when a delicate balance and exact weights are not available.

Keep the solution in small, dark amber-colored, glass-stoppered bottles, carefully protected from dust.

Note.—When this solution is to be used, fill a burette with it, place the liquid to be tested either for the free iodine it already contains, or for that which it liberates from an excess of potassium iodide added to it, into a flask, and gradually add small portions of the solution from the burette, shaking after each addition, and regulating the flow to drops towards the end of the operation, until the brown color of the iodine has nearly disappeared. Now add a few drops of starch T.S., which will produce a blue color, and then continue to add the hyposulphite solution in drops until the blue tint is exactly discharged.

One Cubic Centimeter of Decinormal Sodium Hyposulphite V.S. is the equivalent of:

	Gramme.
Sodium Hyposulphite (Thiosulphate), $Na_2S_2O_3 + 5H_2O$	0.024764
Bromine, Br	0.007976
Chlorine, Cl	0.003537
Iodine, I	0 012653
Iron, Fe, in ferric salts	0.005588

The following articles are tested with this solution:

	Gm. taken.	C.c required.	Percent. of strength indicated.	
Aqua Chlori	17.7	20.0	0.4	of chlorine.
Calx Chlorata	0.354	35.0	35	of chlorine.
Ferri Chloridum	0.56	20.0	20	of iron.
Ferri Citras	0.56	*16.0	*16	of iron.
Ferri et Ammonii Citras	0.56	*16.0	*16	of iron.
Ferri et Ammonii Sulphas	0.56	11.6	11.6	of iron.
Ferri et Ammonii Tartras	0.56	*17.0	*17	of iron.
Ferri et Potassii Tartras	0.56	*15.0	*15	of iron.
Ferri et Quininæ Citras	0.56	*14.5	*14.5	of iron.
Ferri et Quininæ Citras Solubilis	0.56	*14.5	*14.5	of iron.
Ferri et Strychninæ Citras	0.56	*16.0	*16	of iron.
Ferri Phosphas Solubilis	0.56	*12.0	*12	of iron.
Ferri Pyrophosphas Solubilis	0.56	*10.0	*10	of iron.
Ferri Valerianas	0.56	15.0 to 20.0	15 to 20	of iron.
Ferrum Reductum	0.056	8.0	80	of iron.
Iodum	0.32	25.0	98.85	of iodine.
Liquor Ferri Acetatis	1.12	*15.0	* 7.5	of iron.
Liquor Ferri Chloridi	1.12	*26.0	*13	of iron.
Liquor Ferri Citratis	1.12	*15.0	* 7.5	of iron.
Liquor Ferri Nitratis	1.12	* 2.8	* 1.4	of iron.
Liquor Ferri Subsulphatis	1.12	*27.2	*13.6	of iron.
Liquor Ferri Tersulphatis	1.12	*16.0	* 8	of iron.
Liquor Iodi Compositus	12.66	49.3 to 50.	5	of iodine.
Liquor Sodæ Chloratæ	6.7	50.0	2.6	of chlorine.
Tinctura Ferri Chloridi	1.12	* 9.4	* 4.7	of iron.
Tinctura Iodi	6.3 C.c.	*35.0	* 7 Gm.	of I in 100 C.c.

134. Normal Sulphuric Acid.

$H_2SO_4 = 97.82$. 48.91 Gm. in 1 Liter.

Carefully mix 30 C.c. of pure, concentrated sulphuric acid (of specific gravity 1 835) with enough water to make about 1050 C.c., and allow the liquid to cool to about 15° C. (59° F.). Place 10 C.c. of this liquid (which is yet too concentrated) into a flask, add a few drops of phenolphtalein T.S., and afterwards, from a burette, normal potassium hydrate V.S., shaking after each addition, and regulating the flow to drops towards the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of C.c. of potassium hydrate consumed. Then dilute the sulphuric acid solution so that equal volumes of this and of normal potassium hydrate V.S. exactly neutralize each other.

Example.—Assuming that 10 C.c. of the acid solution first prepared had required exactly 11.2 C.c of normal potassium hydrate V.S., each 10 C.c. of the former must be diluted to 11.2 C.c., or each 1000 C.c. to 1120 C.c.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 50 C.c. of the acid solution should require for neutralization exactly 50 C.c. of potassium hydrate V.S. If necessary, a new adjustment should be made to render the correspondence perfect.

Note.—It is recommended that, in alkalimetric determinations, when an acid of normal strength is required, normal sulphuric acid be employed, in place of normal oxalic acid V.S. (see note under No. 122).

One Cubic Centimeter of Normal Sulphuric Acid is the equivalent of:

	Gramme.
Sulphuric Acid, absolute, H_2SO_4	0.04891
Ammonia Gas, NH_3	0.01701
Ammonium Carbonate, $(NH_4)_2CO_3$	0.042935
Ammonium Carbonate [U. S. P.], $NH_4HCO_3.NH_4NH_2CO_2$	0.05226
Lead Acetate, crystallized, $Pb(C_2H_3O_2)_2 + 3H_2O$	0.18900
Lead Subacetate, assumed as $Pb_2O(C_2H_3O_2)_2$	0.13662
Lithium Benzoate, $LiC_7H_5O_2$ (to be ignited)	0.12772
Lithium Carbonate, Li_2CO_3	0.036935
Lithium Citrate, $Li_3C_6H_5O_7$ (to be ignited)	0.0698566
Lithium Salicylate, $LiC_7H_5O_3$ (to be ignited)	0.14368
Potassium Acetate, $KC_2H_3O_2$ (to be ignited)	0.09789
Potassium Bicarbonate, $KHCO_3$	0.09988
Potassium Bitartrate, $KHC_4H_4O_6$ (to be ignited)	0.18767
Potassium Carbonate, anhydrous, K_2CO_3	0.068955
Potassium Citrate, crystallized, $K_3C_6H_5O_7 + H_2O$ (to be ignited)	0.10786
Potassium Hydrate, KOH	0.05599
Potassium and Sodium Tartrate, $KNaC_4H_4O_6 + 4H_2O$ (to be ignited)	0.14075
Sodium Acetate, $NaC_2H_3O_2 + 3H_2O$ (to be ignited)	0.13574
Sodium Benzoate, $NaC_7H_5O_2$ (to be ignited)	0.14371
Sodium Bicarbonate, $NaHCO_3$	0.08385
Sodium Borate, crystallized, $Na_2B_4O_7 + 10H_2O$	0.19046
Sodium Carbonate, anhydrous, Na_2CO_3	0.052925
Sodium Carbonate, crystallized, $Na_2CO_3 + 10H_2O$	0.142725
Sodium Hydrate, $NaOH$	0.03996
Strontium Lactate, $Sr(C_3H_5O_3)_2$ (to be ignited)	0.13244

The following articles are tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength indicated.	
Ammonii Carbonas	2.613	50.0	100	of pure salt.
Aqua Ammoniæ	3.4	20.0	10	of dry gas.
Aqua Ammoniæ Fortior	1.7	28.0	28	of dry gas.
Liquor Plumbi Subacetatis	13.67	*25.0	*25	of basic salt.
Liquor Potassæ	28.00	25.0	5	of hydrate.
Liquor Sodæ	20.00	25.0	5	of hydrate.
Lithii Benzoas (to be ignited)	1.0	7.8	99.6	of pure salt.
Lithii Carbonas	0.5	13.4	98.98	of pure salt.
Lithii Citras (to be ignited)	1.0	14.2	99.2	of pure salt.
Lithii Salicylas (to be ignited)	2.0	13.8	99.13	of pure salt.
Potassa	0.56	9.0	90	of hydrate.
Potassii Acetas (to be ignited)	1.0	10.0	98	of pure salt.
Potassii Bicarbonas	1.0	10.0	100	of pure salt.
Potassii Bitartras (to be ignited)	1.88	9.9	99	of pure salt.
Potassii Carbonas	0.69	9.5	95	of anhyd. salt.
Potassii Citras (to be ignited)	1.08	10.0	100	of crystall. salt.
Potassii et Sodii Tartras (to be ignited)	1.41	10.0	100	of pure salt.
Soda	0.4	9.0	90	of hydrate.
Sodii Acetas (to be ignited)	1.36	10.0	100	of pure salt.
Sodii Benzoas (to be ignited)	2.0	13.9	99.8	of pure salt.
Sodii Bicarbonas	0.85	10.0	98.6	of pure salt.
Sodii Carbonas, anhydrous	1.0	18.7	98.9	of anhyd. salt.
Sodii Carbonas Exsiccatus	1.0	18.8	*78	of anhyd. salt.
Spiritus Ammoniæ	3.4	20.0	10	of ammonia.
Strontii Lactas (to be ignited)	1.33	9.9	98.6	of pure salt.

135. Decinormal Sulphuric Acid.

$H_2SO_4 = 97.82$. 4.891 Gm. in 1 Liter.

Dilute 10 C.c. of normal sulphuric acid with enough water to make 100 C.c.

One Cubic Centimeter of Decinormal Sulphuric Acid is the equivalent of:

	Gramme.
Sulphuric Acid, absolute, H_2SO_4	0.004891
Combined Alkaloids of Nux Vomica, assumed to consist of equal parts of Strychnine and Brucine	0.0364
Potassium Hydrate, KOH	0.005589

The following article is tested with this solution:

	Gm. taken.	C.c. required.	Percent. of strength required.
Extractum Nucis Vomicæ	0.4	[1] 1.66	15 of total alkaloids.

V. ALKALOIDAL ASSAY BY IMMISCIBLE SOLVENTS.

It is a property of many alkaloids that they are soluble in certain liquids in which their salts are insoluble, while in other liquids the case is reversed. When such liquids are not miscible, the conditions are favorable to what has been called the "shaking-out" process of separation. In many cases the extraction or separation may be effected by shaking together the concentrated aqueous extract, to which a suitable alkaline precipitant has been added, and some solvent, such as chloroform, ether, benzin, benzol, amyl alcohol, etc. The precipitated alkaloid is thus washed out of the aqueous solution, and is dissolved by the chloroform or other immiscible liquid employed. From the solution of the alkaloid thus obtained, the latter may again be abstracted by a dilute acid. In this Pharmacopœia the only liquid which is directed as solvent for alkaloids in such assays is *chloroform*. The extraction is directed to be performed in a glass separator or separatory funnel, which consists of an elongated (globular, cylindrical, or conical) glass vessel, provided with a well-fitting stopper and an outlet-tube containing a well-ground glass stop-cock.

When the solution of an alkaloid, suitably prepared, is introduced into this vessel, and chloroform subsequently added, the latter, owing to its higher specific gravity, will form the lower layer. If the two layers are violently shaken together, there will often result an emulsion, which will separate only slowly, and often imperfectly. This is particularly liable to happen when the aqueous liquid containing the alkaloid either in suspension or in solution is strongly alkaline, and when it has a high specific gravity. To avoid the formation of an emulsion, the extraction should be accomplished rather by rapid rotation and frequent inversion of the separator than by violent shaking. When an emulsion has formed, its separation may be promoted by the addition of more of the solvent, preferably somewhat heated, aided, if necessary, by the external application of a gentle heat (the stopper being removed for the time being), or by the introduction of a small quantity of alcohol or of hot water. The separation of the two layers may also be promoted by stirring the lower, chloroformic layer with a glass rod and detaching from the walls of the separator the adhering drops of emulsion.

On withdrawing the chloroform solution of an alkaloid from the separator, a small amount of the solution will generally be retained in the outlet-tube by capillary attraction. If this were lost, the results of the assay would be seriously vitiated. To avoid this loss, several successive, small portions of chloroform should be poured into the separator without agitation, and drawn off through the stop-cock to wash out the outlet-tube.

Another source of loss is the pressure sometimes generated in the separator by the rise of temperature caused when an alkaline and an acid liquid are shaken together. On loosening the stopper, the liquid which adheres to the juncture of the latter with the neck is liable to be ejected. This is best avoided by mixing the liquids at first by rotation (avoiding contact of the contents with the stopper), and allowing them to become cold before stoppering the separator.

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[1] To be determined to at least two decimals by titrating the uncombined acid with centinormal potassium hydrate V.S.

The same precautions should be observed when an alkali carbonate has been used, in place of a caustic alkali, for setting free the alkaloid. In this case the liquids should be cautiously and gradually mixed by rotation, and the separator should be left unstoppered until gas is no longer given off.

If a regular glass separator is not available, an ordinary burette, stoppered with a sound cork, may be employed in its place. In this case the quantities of the alkaloidal solution and of the volatile solvent must be adjusted to the size of the burette.

QUESTIONS ON CHAPTER LXII.

PHARMACEUTICAL TESTING.

What is meant by synthesis?
What is meant by analysis?
Upon what are the principles of analysis based?
What are meant by reagents and test-solutions?
What two kinds of analysis are in use?
What is meant by qualitative analysis?
What is meant by quantitative analysis?
What two kinds of quantitative analysis are in use, and what is the difference between them?
What is the legitimate and proper meaning of a normal solution?
What are decinormal and centinormal solutions?
In what other ways has the term normal solution been applied?
What is meant by proximate analysis?
What is meant by ultimate analysis?
What system is used by the U. S. Pharmacopœia in analytical operations requiring definite weights or measures?
What is the use of graduated flasks?
What is the use of graduated jars?
What is a burette, and how is it used?
For test-solutions that are decomposed by organic substances, can a rubber tube be used?
What can be used in its place?
What is Erdmann's float? What is its use?
How may pipettes sometimes be used instead of burettes?

PART V.

MAGISTRAL PHARMACY.[1]

UNDER the head of Magistral or Extemporaneous Pharmacy will be considered the preparation and dispensing of medicines intended *to meet the occasion* and which are to be compounded at once. The subject of official or galenical pharmacy has been considered in the previous pages, the distinction being that in the latter the preparations are intended to be permanent, and are generally made in advance and kept on hand ready for use, whilst those which are magistral are mostly intended to last during the occasion which calls them into existence.

There are several classes of official medicines in which permanent and extemporaneous preparations are both embraced: it has been deemed most practical to consider such under the above head. Examples are found in plasters, powders, ointments, etc. Some of these are generally kept on hand ready for use. If they are not called for soon, they become stale or deteriorated, and experience soon demonstrates that the best plan is rapidly to improve the apparatus and facilities of the store to the highest point, so that all extemporaneous preparations may be quickly and skilfully compounded on call, and thus a reputation is soon acquired for always dispensing those which are fresh. For this reason, most ointments should not be made in larger quantities than are necessary to supply the demand of the moment.

Magistral Pharmacy is unquestionably the most important division of the whole subject. It embraces the principal amount of the labor in the store, and calls for the exercise of more tact, knowledge, and ability than any other branch. Owing to the fact that the ability to practise extemporaneous pharmacy successfully depends largely upon the personal qualities of the pharmacist, very little can be written upon the subject which would be generally useful. Good training under the watchful eye of a skilled preceptor and practical experience will alone give the confidence and knowledge of details that assure success. All that will be attempted under this head will be to collect and arrange such points as the author has found useful in his own experience, in the hope that at least some of them may be of service to others. A chapter on the arrangement of the store, with a description of the facilities for practising extemporaneous pharmacy, will properly introduce the subject.

[1] The word magistral is derived from *magister*, a master, and is defined as "a term applied to medicines prescribed for the occasion, by a competent person, in distinction from such as are official, or kept prepared in the shops. As the latter are prepared according to a certain formula, an intelligent apprentice is generally equal to the task; but the knowledge of a master is needed to give directions for an original preparation."—*Thomas.*

CHAPTER LXIII.

DISPENSING.

Arrangement of the Store, Laboratory, and Cellar.

Selecting a Location for a Dispensing Store.—The selection of a proper location for establishing a pharmacy is in some respects the most important and responsible of all the duties of the pharmacist. As it is largely a question depending upon the personal qualifications, attainments, and financial ability of the individual or firm, it would be useless to offer anything more than a general observation upon this subject. Every pharmacist should select the location in which he will be most likely to achieve the greatest amount of *success*. The foregoing sentence will probably be construed by most readers to mean the field which will yield the largest pecuniary return; yet he is wisest whose expectations are tempered with moderation, and who looks for his reward to the happiness and satisfaction derived from a life filled with those daily deeds of service to his fellow-men, which from long custom or lack of appreciation fail to be classed as merchantable commodities. The general practice in America is to select a prominent place for a pharmacy at the intersection of principal streets, and the "corner drug-store" is a well-known phrase. Aside from the business view concerned in this selection, there is a great advantage derived from the presence of better light and ventilation in a corner location. At the same time, there are the disadvantages of double the amount of dust and exposure from the streets, with the necessary depreciation of the stock, as well as others of minor importance.

Apportioning Space.[1]—The room should be at least twice as long as it is broad, in order that a suitable division of the space may be secured, so that about two-thirds may be devoted to dispensing and one-third to compounding. A high ceiling is a great desideratum. The doors should be ample, with movable transoms to secure ventilation and permit the escape of the heated air and vapors which accumulate from the lights at night and from other sources. The transoms may be suspended in the middle, and during the day, even in winter, if they are kept partly opened, the condensation of moisture upon the glass bulk-windows, due to evaporating operations going on in the store or laboratory, will be largely avoided. If a chimney-breast is available in the room, it will be found a desirable acquisition in aiding in ventilation and the escape of noxious vapors arising from chemical operations.

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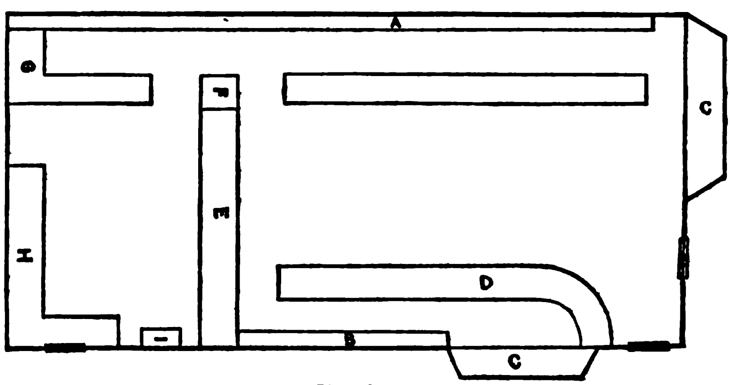
[1] For some excellent suggestions as to the arrangement of fixtures, etc., see a paper by J. F. Hancock, Proc. Amer. Pharm. Association, 1872, p. 192.

The dispensing department is used principally for displaying the stock and for conducting the business with the customers, the prescription department for compounding prescriptions and making preparations. Much diversity of opinion exists among good pharmacists with regard to the proper method of division between these two departments. Some hold that they should be entirely separated from each other, the prescriptions being compounded in a separate room; others, that nothing but a low counter should mark the dividing-line. Probably the most satisfactory arrangement to adopt is to place across the store a prescription counter having a large glass plate in the centre, which will permit the customer to see into the prescription department if he desires to, but which will not be a standing invitation to inquisitive persons to walk in and annoy by conversation those who are engaged in compounding prescriptions.

FIG. 366.



Plan of store.

Fig. 366 shows the plan of a corner pharmacy adapted for a moderate business. It provides for two windows, C C, and two doors. A B represents the space devoted to upright fixtures and shelving,—A, the former, for the bottles, drawers, cans, drawer-cans, etc.; B, closets for holding finished packages ready for sale. In front of A the long main counter is shown, whilst D represents the second counter. The spaces E and F are apportioned for the prescription counter, and the adjoining desks, G and H, show spaces devoted to working counters for pharmaceutical operations, while I represents the sink.[1]

Window-Fixtures.—Plate-glass, although expensive, is now so generally in use, and so satisfactory, that it is usually true economy to select it for bulk-windows.

The principal adornments of the pharmacist's window are those ancient emblems of his art,—the show-bottles. These should never be exhibited if they cannot be made to present a creditable appearance. They need not be of elaborately cut glass, but the colored liquids should be bright and transparent and the bottles clean and free from dirt and dust. (Formulas for show-bottle colors are given in Part VI.)

[1] Estimates, plans with illustrations, etc., are now freely furnished by druggists' outfitters. (See advertisements in the pharmaceutical journals.)

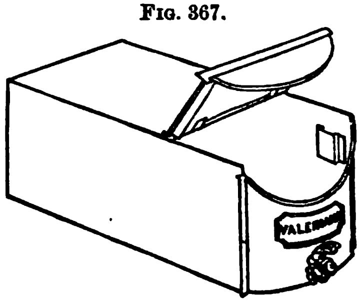
Arrangement of Objects.—One of the most difficult subjects to treat is the proper arrangement of a pharmacist's window. In the general stores of our large cities, window-dressing, as it is termed, is in the hands of trained men, who earn a comfortable livelihood by the "profession." It is far easier to note the objects which should not be exposed than to indicate those which are suitable. *Legitimate and proper objects are always found in the products of the pharmacist's own skill and labor.* Many chemical salts can be crystallized in thin glass dishes, and these, if the salt is colorless or white, can be shown to advantage on a background of black velvet; if the salt is dark-colored, like chrome alum, a white background should be chosen. Masses of crystals of various colors, alum, copper sulphate, potassium ferrocyanide, etc., form attractive objects, if they are novelties. These may be obtained from the manufacturing chemists. Chemical or pharmaceutical apparatus, tastefully displayed, rarely fails to excite the admiration of the passers-by, whilst if some simple pharmaceutical process is shown in automatic operation, such as the distillation of water or colored liquids in glass retorts, with a glass Liebig condenser, two objects are gained: a supply of the distillate is secured, and the reason for possessing the window is legitimately realized. Growing plants of the materia medica can often be obtained by applying to conservatories, or, with the exercise of a little patience and care, some of these may be grown at home. If these plants be rare, or of foreign origin, the interest will be greatly enhanced. This point, however, should always be kept in view: the objects should have some connection with pharmacy. Appropriate labels should accompany the objects exhibited, or the annoyance of having to answer trivial questions many times in the day will be experienced. An instructive *series* of pharmaceutical exhibitions may be devised, the series to extend through many months. To illustrate: an empty ceroon which has held cinchona bark should be obtained, and a reproduction made, through the aid of some friend clever with the pencil, of some of the prints to be found in the books, of natives gathering cinchona bark, and also of the cinchona-tree. Some large, handsome pieces of the bark should be selected, showing the different grades and qualities. Then there should be exhibited, in appropriate bottles, a series of all the *home-made* pharmaceutical preparations of cinchona bark, and, for the centre-piece, choice specimens of all the cinchona alkaloids; then the pharmaceutical preparations of the alkaloids in the background, etc. A clearly-written statement should be shown in the window, giving interesting details of each object. When the interest in this subject has waned, the same method may be applied to nux vomica, coca, rhubarb, opium, eucalyptus, senna, etc., and other similar subjects. It will be readily seen that the purpose of exhibitions of this character is to impress the community with the fact that the proprietor of the store is not only a merchant and dealer in the products of the skill of others, but is also a manufacturer himself.

Exhibitions of a more elaborate and valuable character will readily suggest themselves to the minds of many; but want of space prevents any further hints on our part. It must be clear, however, that

displays of the above character are more in keeping with the professional status of the pharmacist in the community than the heterogeneous and often vulgar exhibitions of objects usually seen in druggists' show-windows.

Shelving and Wall-Fixtures.—The character of the permanent fixtures of the store has much to do with the comfort and convenience of conducting a pharmacy. The selection of the kind of wood to be used will depend upon the amount of light in the store, the location, and the climate. *Hard wood* is always the cheapest in the end, although the most expensive at first. If the room is exposed to a great deal of light, black walnut is to be preferred, because it shows discolorations less than any other hard wood; but if the tone of the room is dark, a more cheerful appearance must be given to the store, and oak, ash, cherry, or mahogany will be preferable: oak and ash, however, are not so serviceable as the others, because of their tendency to show stains. The wall-fixtures generally consist of a long row of drawers four feet high, with shelves above for holding the shop-bottles, cans, etc., on one side, and of a series of closets below, with shelves having glass fronts above, for the other side. Most crude drugs and chemicals, herbs, etc., are kept in wooden drawers arranged in sections. The objections to wooden drawers for this purpose are several. If the drug is odorous, like valerian, sassafras, asafetida, etc., it will surely communicate its peculiarities to its less-pronounced neighbors, like arrowroot, bicarbonate of soda, etc. Again, rats and mice have strong likings for some of the articles of the materia medica, and a wooden drawer offers no impediment to their sharp teeth. Japanned and lacquered tin or tinned-copper cans appropriately labelled have come into use as substitutes, and when properly made are perfectly satisfactory. Fig. 367 shows a can which is intended to take the place of a drawer. The lid is so arranged that the drawer must be pulled out nearly half-way before it can be raised,—the advantage being that the bad habit of leaving the drawers partly open, thus permitting the admission of foreign substances, vermin, etc., is obviated, there being but two possible positions for this drawer-can: one with the lid raised and the mouth of the can wide open, the other with the lid down close. The label-case in the corner is the suggestion of Charles A. Heinitsh, of Lancaster. It has the merit of keeping the label for each drug in its appropriate container. Instead of the unbroken and monotonous array of drawers so frequently seen, a more convenient arrangement, presenting a better appearance, will be found to consist in alternating the sections of drawers or drawer-cans with closets, as shown in Fig. 368. These closets should be used for packages and articles which are generally in active demand and which must be dispensed quickly. In this connection it may be stated that a stock of small packages of regular articles of the materia

FIG. 367.

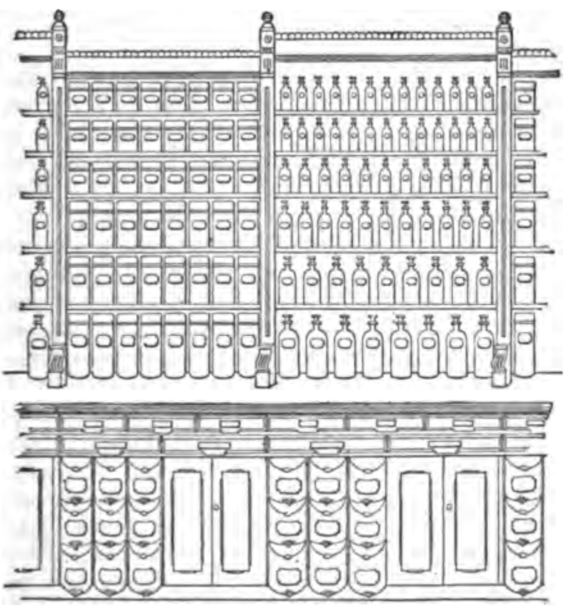


Drawer-can.

medica, like flowers of sulphur, cream of tartar, bicarbonate of sodium, in the quantities frequently demanded by customers, should be kept in a box or compartment of the drawers or drawer-cans. This plan greatly facilitates quick dispensing, economizes time and labor, and leads the assistant to make neat packages, by training him in that duty thoroughly at times when he is not otherwise engaged. If there is not room in the proper receptacle for these labelled packages, they may be kept in glass furniture-jars in some accessible place.

Fig. 368 also illustrates the arrangement of two sections of fixtures, one for bottles and the other for cans. Each section should be independent, or joined to its neighbor with dowel-pins, so that at any time they may be separated, rearranged, if necessary, or taken down entirely. The design shown is unpretentious, and intended for a store doing a moderate business. If the fixtures are made of mahogany, oak, or walnut, the effect is much better than if soft wood, painted or stained, is used. It will be observed that the proportionate height of the fixtures is such that a short ladder is necessary to reach the top row of bottles and cans. This arrangement is a matter of necessity in stores located in large cities and towns, where space is very valuable; but whenever it can be avoided it is desirable that it should be; and if the shelves are carried to just such a height as will permit the bottles to be reached without using a ladder, much inconvenience will be obviated. The careless habit of pulling out a drawer as a step to reach a bottle on an upper shelf is broken up by the use of the drawer-cans and closets, as shown in the illustration. The shallow drawers above these are not intended for holding drugs, but serve to contain small articles in constant demand, like camel's-hair pencils, gelatin pearls, seidlitz powders, etc. There should be sufficient difference between the depth of the shelves for the bottles and cans and that of the closets below to permit an eight-inch counter-top to be made above the closets. This will be almost indispensable, as affording a place for retaining packages to be sent out and of temporary lodgment for articles re-

FIG. 368.

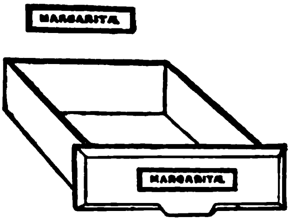


Section of wall-fixtures.

ceived. This counter should be cleared and all articles distributed every morning before the busy hours arrive.

Fig. 369 shows one of these shallow drawers. The label is the principal feature. It was devised by the author some years ago, to replace the labelled drawer-pulls furnished by the dealers in druggists' furniture, which were in use at that time and were objectionable in several respects. The simplicity and durability of this label are its prominent advantages. It is made of plate-glass, with bevelled edges; the background is of pure gold-leaf, and the letters are black and in plain Egyptian style, or black letter, without shading. They are painted upon the back of the glass, and covered with a coat of varnish. The glass label is let into the front of the door by chiselling out a depression, as deep as the glass is thick, slightly larger than the label. The back of the glass label is then covered with a thick paste of red lead in boiled linseed oil and pressed into place, the edges being finished with colored putty. The lower edge of the drawer has a projection which serves as a pull.

FIG. 369.



Shallow drawer.

Dispensing Counter.—The arrangement of the dispensing counter will depend upon whether it is to serve also as a prescription counter. A combination counter should always be avoided, if possible, as the operations involved in compounding prescriptions require the closest attention, and should always be performed where the greatest freedom from interruption can be secured. This can never be had behind the dispensing counter. The plans shown on page 988 do not, therefore, embrace a combined dispensing and prescription counter; but, if one is absolutely necessary, the main features of each can be easily merged into one. The top of the dispensing counter should be of marble or hard wood. Where space is valuable, the top of the front of the counter may overhang four inches, and room thus be obtained for a row of shelving covered with glass doors: these are shown also in front of the prescription counter (see Fig. 378). If the shelves are filled with attractive objects, particularly with special preparations made by the proprietor, they serve the excellent purpose of keeping them continually before the eye of those who frequent the store, and they may justly be called "silent salesmen." If a triangular base four inches high is placed at the bottom, no danger need be apprehended of customers breaking the glass. The case in the author's possession has been in daily use ten years without a single fracture occurring through the carelessness of a customer. The glass should be one-eighth-inch plate. If space is not particularly valuable, the counter front may be embellished with pilasters or panels, according to the taste of the owner, and the preparations shown in glass cases. A hard-wood counter will, however, prove to be much the cheaper in the end, as the front is subjected to a great deal of wear and tear and will require frequent painting if made of soft wood. The back of the counter should be utilized for containing drawers for heavy, unsightly goods, supplies

of paper, corks, twine, sponges, glue, sand-paper, plaster, labels for articles to be dispensed, etc. A sink at one end will often prove a convenience: it will, indeed, be necessary if soda-water is dispensed at this counter.

Store Furniture.—This term generally denotes the containers used to hold the medicinal substances which are to be dispensed. The furniture may consist of wide-mouth or salt-mouth bottles, wooden drawers, drawer-cans, and cans or counter-urns, for the solid articles of the materia medica, whilst the liquids are universally dispensed from bottles and cans. The furniture other than that made from glass has been already considered under the head of fixtures. The subject of the selection of the glass-ware in such sizes and shapes as shall be adapted to the wants of the store is an important one. Very little assistance, however, can be rendered in a work of this kind, because a list suitable for a store in one location would be useless for one differently situated. Practice has been materially modified of late years, particularly in arranging the *sizes* of the shop-bottles for liquids. Formerly, when tinctures were made by maceration, gallon, two-gallon, and even three-gallon bottles were to be seen upon the lowest shelf, but now it is rare to see larger than half-gallon bottles; indeed, there seems to be very little necessity for bottles larger than quart. The stock of liquid preparations being generally kept in the cellar, the shop-bottles are easily replenished from time to time as need arises. In selecting the sizes for the containers, whether of glass, tinned iron, or wood, the space to be devoted to them should first be decided upon, and then the number of bottles, cans, or drawers to occupy the space is easily determined. Having ascertained the number required of each, the selection of the proper-sized receptacle for each article should next claim attention. The following points may serve as a guide in selecting the kind of container:

1. Solid substances which are subject *to injury by exposure to light* should not be placed in glass, like salts of the alkaloids, scaled-iron salts, powdered savin, digitalis leaves, etc. 2. Odorous drugs, like hedeoma, asafetida, valerian, serpentaria, etc., should not be placed in wooden drawers, but should be put into the shop-cans. 3. Volatile oils should not be placed in the pharmacist's shop-furniture at all: small quantities only are dispensed, and the oils should be kept in small amber-glass bottles, away from exposure to light, preferably in a close closet. 4. Corrosive or deliquescent salts should not be placed in tinned-iron cans: glass vessels are properly used for these.

Glass Furniture.—Shop-bottles are generally of four kinds,—*wide-mouth* or *salt-mouth*, *tincture* or *narrow-mouth*, *syrup*, and *oil* bottles. Amber and blue glass are sometimes used,—the former for substances which are injured by light, the latter for very active poisons. Figs. 370 and 371 show cuts of the wide-mouth and other shop-bottles supplied by Whitall, Tatum & Co., of Philadelphia. A difference of opinion exists among pharmacists as to the advantage of fitting out with bottles of extra-heavy glass or with those of ordinary weight: a certain number have to be replaced every year through breakage from careless handling, but it would seem to be most economical to select the

extra-heavy bottles for liquids, notwithstanding that the percentage of loss is greater with these when the practice of suddenly pouring hot liquids into them is indulged in.

Fig. 370.

Wide-mouth furniture-bottle.

Fig. 371.

Narrow-mouth furniture-bottle.

Fig. 372.

Oil-bottle.

Fig. 373.

Syrup-bottle.

The *oil-bottle* (see Fig. 372) has a cap, which protects the liquid from dust; the neck of the bottle is stopped by a tube which has a lip, whilst the base of the tube is grooved on one side, to permit the oil adhering to it to flow back into the bottle.

The *syrup-bottle* (see Fig. 373) does not have a ground, close-fitting stopper as do the other bottles holding liquids, but the stopper is purposely made to enter the neck loosely; the flat lower surface of the stopper lies in contact with the upper surface of the lip of the bottle, and this forms a sufficiently tight connection to prevent loss by evaporation, exclude dust, and obviate the great inconvenience and loss of time which frequently occur when the ground-glass stopper of the syrup-bottle is found tightly cemented in the neck and a restive customer is waiting: the loose-stoppered syrup-bottle may at such times be justly regarded as a moral help, leaving no excuse for the use of smothered, but none the less intense, expressions of internal feeling. In dispensing the liquid, care should be taken to pour from the bottle with the label uppermost, so as to avoid soiling the label. The habit should be cultivated of catching the last drop from the lip on the end of the stopper, to prevent its trickling down the side of the bottle: if this is not done, a syrup-bottle may present the appearance shown in Fig. 374.

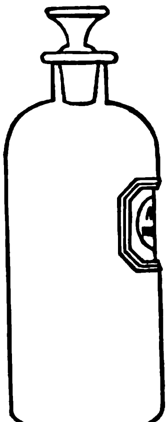
Fig. 374.

Last-drop effects.

In placing the bottles upon the shelves, an alphabetical arrangement

is undoubtedly the best: it is well, however, to group the strong acids in one place, and the very poisonous liquids in another. The labelling should be distinct and easily read, and the abbreviations not so short as to allow of any misunderstanding; there should be no shading of the letters; the plain black Egyptian letter on a plain gold ground is the best on this account, whilst the combined effect in a row of bottles so labelled is richer than where some obscure or composite style of label is adopted. The glass or mica label is universally used now for bottles,—being cemented on with a cement consisting of three parts of rosin and one part of wax,—paper labels having almost gone out of use. These glass labels are subject to the disadvantage of being easily cracked and chipped, but they can be replaced so cheaply that this cannot be considered a serious objection. The recessed label has an advantage in this respect, the octagonal depression in the bottle enabling the glass label to be cemented in its place without exposing the edges, thus giving it protection. Fig. 375 shows a profile view of this label.

FIG. 375.



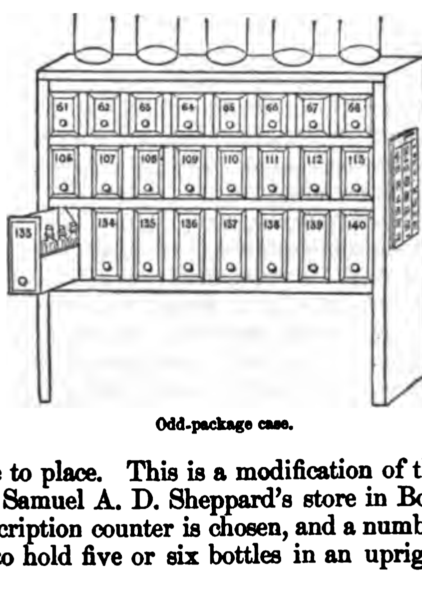
Recessed label furniture-bottle.

The following directions for attaching the glass labels are furnished by Whitall, Tatum & Co.:

Cement.—To one part of best yellow wax add three parts of rosin; melt together in an open pan or kettle, with a gentle heat, to the consistency of syrup.

Directions.—Place the bottle on a table in a nearly horizontal position in front of you; the bottle must be perfectly free from moisture. Pour the cement on the hollow side of the label with a spoon; then apply the label to the bottle with a gentle pressure. While the cement is soft, run the point of a knife around the label, so as to form a groove in the cement: this will save labor in chipping off the cement. The cement will harden in about ten minutes, when, with a putty-knife such as glaziers use, the surplus is to be removed. Clean the bottle and label with a little kerosene oil, and wipe off with a damp towel.

FIG. 376.

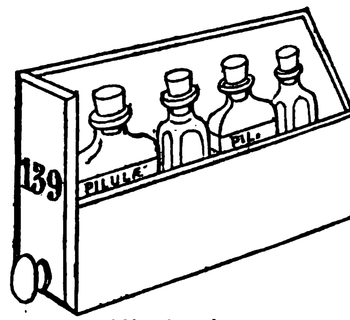


Odd-package case.

Fig. 376 shows a method of systematically storing little odd packages which are troublesome to place. This is a modification of the plan first seen by the author in Samuel A. D. Sheppard's store in Boston. A section back of the prescription counter is chosen, and a number of small drawers are arranged to hold five or six bottles in an upright

position. Fig. 377 shows an enlarged view of one of these drawers. A portion of one of the sides and of the back is cut away, to facilitate the handling of the bottles. The fronts of the drawers are of hard wood, and the drawers are numbered distinctly and consecutively. Upon the side of the section an index to the contents of the drawers is placed: this consists of a complete alphabetical list of all the odd packages in the section, and opposite each article is placed the number of the drawer in which it is contained. In practice, the bottles which are in frequent request are easily found, after once being located, without referring to the index. The advantages of this method are plain: pill-bottles, rare chemical salts, odd-sized packages which cannot be easily disposed of, are thus classified and arranged so that they can be quickly found, whilst they are protected from the effects of light, dust, and air.

FIG. 377.



Odd-package drawer.

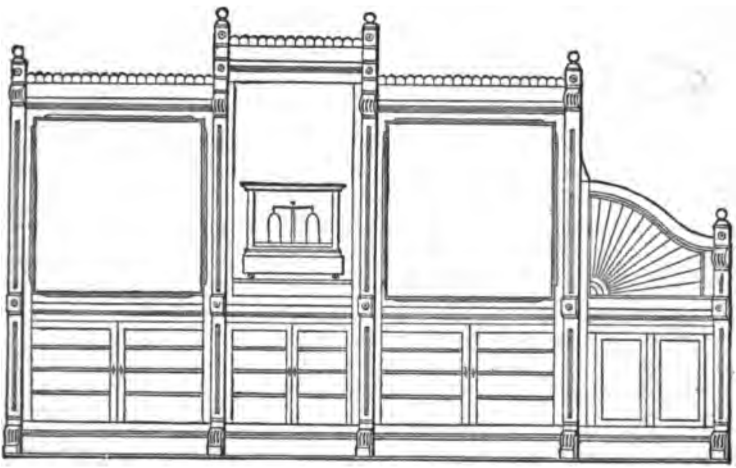
The Prescription Counter.—This will probably require more care and thought to secure the most advantageous arrangement than any other feature of the store. Good light and a convenient water-supply are absolute essentials. A corner location will generally afford a side window, from which plenty of light from the side and back may be had, whilst the sink should be close at hand. The counter should be of the same kind—hard wood—as the fixtures; or, if hard wood has not been used for the fixtures, the counter top at least should be of walnut, mahogany, oak, ash, or cherry.

Fig. 378 shows the front of a prescription counter used by the author. The upper portion is divided into three spaces, of which the middle one is covered with a single sheet of plate-glass, while the other two are occupied by plate-mirrors; the lower portion is divided into closets, which are protected by glass doors, and suitable articles are displayed on the shelves in the closets; these, like the closets under the dispensing counter, are very useful as receptacles for many small articles which are attractive to persons who are waiting for prescriptions.

The arrangement of the back of the prescription counter is probably of more importance than that of any other part of the fixtures. The fact that the customer never sees this part of the store is one of the reasons why it should *not* be neglected. The best reason for devoting thought and care to planning the arrangement of the prescription counter is that here, more than in any other place, the fate of a human life is often decided: hence system, order, and cleanliness should be the guiding rule. Fig. 379 shows the back view of the prescription counter. The upper portion presents a series of open shelves, containing rows of japanned tin cans, uniform in color and in style of label with the shop-cans. The lower shelf, in each section, is devoted to the volatile oils. These are contained in glass-stoppered bottles, which are placed in the cans; or, if preferred, the original bottles in which the oils are bought

are placed in the cans. The oils are thus protected from light, air, and dust, and in the latter case the label of the dealer is constantly before the dispenser, and the quality of the oil under surveillance. The

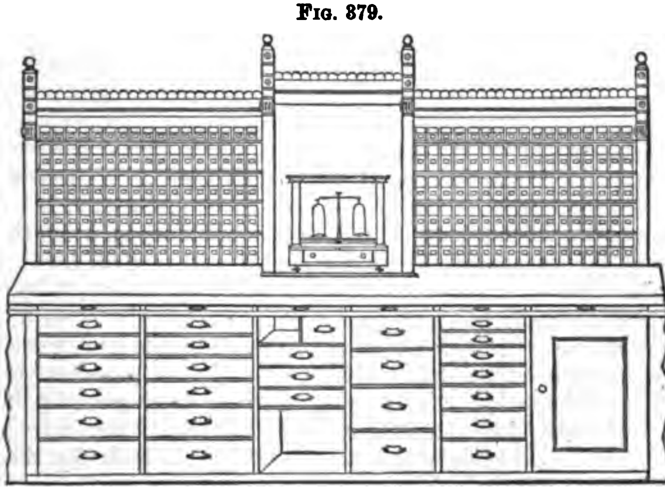
FIG. 378.



Prescription counter, front view.

second, third, and fourth rows are used to hold the chemicals and dry pharmaceutical non-poisonous products which are constantly in use. In compounding prescriptions, some of these cans are filled directly from

FIG. 879.



Prescription counter, back view.

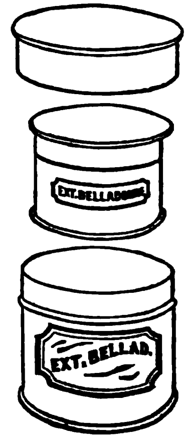
the larger shop-bottles, and the substance, if without action on the tin, is not first put into smaller bottles, but is placed at once in the can. Substances like bromide of sodium, chloral, citrate of potassium, etc.,

are placed in bottles, and these then put into the proper tin cans. Fig. 380 shows one of these cans. The upper row is devoted to extracts, these being contained in jars, as shown in Fig. 381. The cans should be thoroughly japanned, and the label may be painted in large, black, distinct letters upon a gold ground. The substances should be arranged alphabetically, so that they can be readily found when wanted. This arrangement enables the dispenser to exclude the light, air, and dust from the substances, and to use the original bottles in which the manufacturer has sold the chemical, thus enabling the make to be at once identified, besides lessening the danger of errors; whilst another advantage is that the unsightly display of bottles of all sizes and shapes containing chemicals, with the labels more or less worn, soiled, and fly-specked, is avoided. The poisons, alkaloids, and very powerful substances should be kept in a separate closet, and the bottles marked with a poison-mark; for, although the pharmacist should early learn to place no absolute dependence upon any *special system* of preventing errors, but always to realize that constant, unremitting vigilance is the only safeguard, the adoption of some expedient which will aid in calling attention to poisonous compounds serves to impress upon all, particularly the junior assistants, the fact that safety can be secured only at the expense of the most scrupulous care. Fig. 382 shows Holbe's poison closet. The arrangement shows three closets in one: to each is assigned separate apparatus with lock and key. The top of the prescription counter should be made of hard wood, and at least one and a half inches thick if durability is desired. The slides shown just under the edge of the counter are very convenient. They can be relied upon, when they are pulled out, in an emergency to double the capacity of the counter. One of the slides may have a sheet of ground glass set into it by chiselling out sufficient of the wood on the face to allow the glass to be set in flush with the surface of the slide upon a bed of label-cement (three parts rosin and one part yellow wax). This forms a convenient ointment-slab, particularly for making up a rather large quantity of ointment. It is easily cleaned and kept in order. Two of the slides should be appropriated to folding powders and kept exclusively for this purpose, and one reserved for holding the pill-machine when in use, whilst one may have three circular bevelled holes of different diameters countersunk upon the front of the slide. If a strip equal in width to one-half the diameter of these depressions is sawed out, as shown in Fig. 383, and then connected by two screw-bolts which project entirely through the strip, it will be possible, by attaching thumb-screws to the

Fig. 380.

Can for prescription counter.

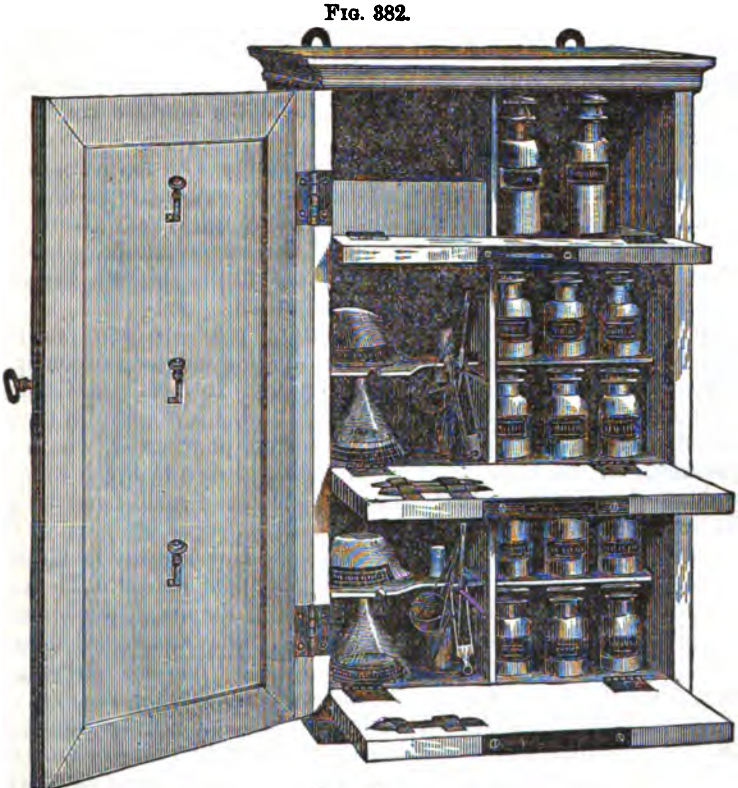
Fig. 381.



Extract-can for prescription counter.

ends of the bolts, to clamp the mortar securely. The depressions should be wider in diameter at the bottom than at the top, so that the "bite"

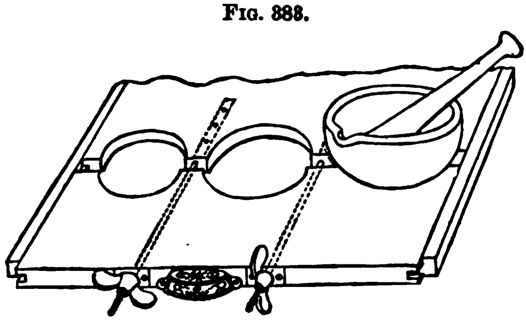
FIG. 882.



Poison closet.

of the clamp will be stronger when the mortar is securely clamped. It is useful in working tough pill masses, or in making emulsions quickly. The drawers in the counter are appropriated to various purposes. Those on the left are partitioned off, and contain pill, powder, and suppository boxes, each in its proper division. Ointment-jars of various sizes occupy another set in the next row; the top drawer and the one immediately below it contain the pill-machines; lozenge-cutters, cachet-machines, suppository-moulds, etc., are in another drawer, spatulas, stirring-rods, etc., in another. Pre-

FIG. 883.



Device for holding mortars.

scription-bottles of all sizes (cleaned and dried, and, if preferred, corked) are in the next section, whilst cut labels, capping-paper and scissors, and corks, in partitioned drawers, find places in the succeeding row. One of the upper drawers in the middle of the counter should be set apart for towels, whilst the open space below is convenient for holding the box to collect the scraps of paper and light waste which accumulate during the day. The closets hold the mortars and pestles, ointment-slabs, etc.

Arrangement of Laboratory and Cellar.—The suggestions that are to be made upon the above subject must necessarily be of a very general character, as the circumstances of pharmacists vary greatly: the apparatus employed in the making of the various preparations has been already considered under the heads devoted to the subjects, hence the general arrangement must now receive attention.

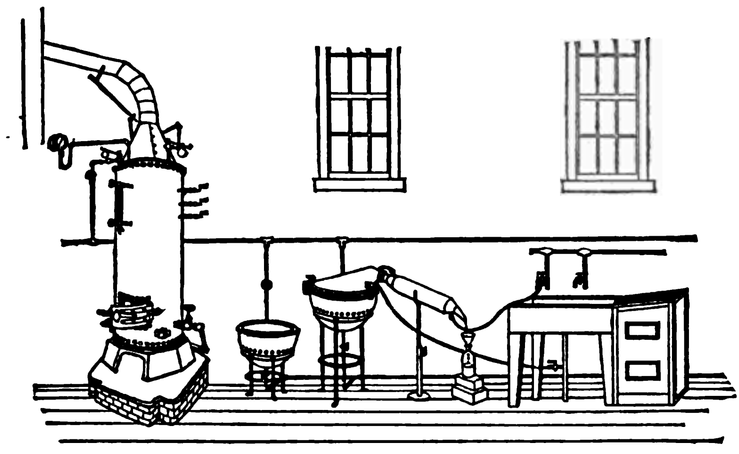
The Laboratory.—This very important room in the pharmacy should be fitted with every facility for carrying on the various operations required, with ease, rapidity, and comfort. In most establishments but one room is available for this purpose, and this directly in the rear of the dispensing-room. The manufacturing pharmacist, who makes preparations on the large scale, is compelled to devote much time and thought to the most advantageous arrangement of space, and he generally selects a location in an unfrequented portion of the town or city, or in the suburbs, where property is cheaper and railway facilities are abundant, whilst the retail pharmacist is fortunate indeed if he can set apart a special room on the first floor adjoining the dispensing-room for a laboratory. The essential features of this room are a good light, an unfailing supply of cold and hot water, a good flue for carrying off vapors, and sufficient room for counters, closets, shelving, etc.

If steam can be introduced, so that steam kettles, evaporators, etc., can be used, it will be a great convenience. The boiler may be most suitably located upon the first floor or in the cellar. In those cases where the space for a permanent boiler cannot be spared, Prof. Patch's small steam boiler may be used (see Fig. 106). This will permit the use of steam without requiring much room, and, when an operation is concluded, the expense of keeping up the fire, as is the case in the use of coal, will be saved. A drying closet (Fig. 188) for desiccating drugs, herbs, lozenges, etc., on trays, is preferably located here, whilst furnaces, gas stoves, etc., must be suitably placed. Closets, arranged to hold stills, condensers, dishes, kettles, funnels, measures, etc., must be provided, whilst working counters, having either wooden tops covered with sheet-lead, or slate tops, must be arranged so as to obtain the greatest number of advantages. Care should be exercised to have the floor, whether of stone or of brick, laid in cement, and slant gradually, so that when it is washed the water will naturally run towards the waste-pipe, which should be located in one corner. If a stone or brick floor is inadmissible, an ordinary board floor, covered with sheet-zinc in those portions likely to become wet, can be made to answer. The following illustrations will serve to give some idea of the general plan of a pharmacist's small working laboratory. The special apparatus is, of course, not figured, as it would interfere with the view of the general arrange-

ment of the counters, etc. For a detailed description of the apparatus the reader is referred to the illustrations in the previous chapters and to the descriptions of the various processes of Operative Pharmacy.

The illustrations represent the counter and apparatus for the four sides of the room. Fig. 384 represents the northern side. This is

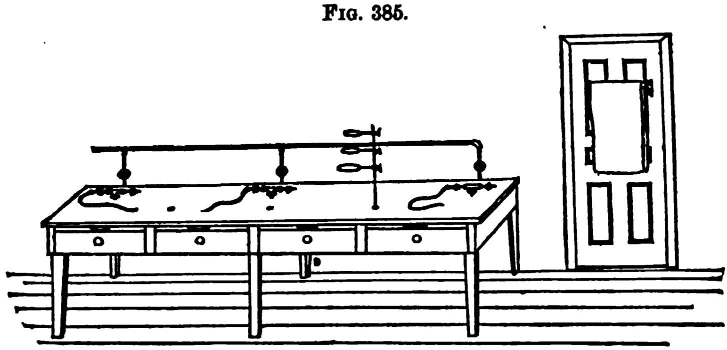
FIG. 384.



Northern side of laboratory.

devoted to the larger operations of evaporation, distillation, etc. The steam boiler, copper kettles, still, sink, etc., being here, a steam-pipe from the boiler may be run into the store for heating purposes or to supply steam for small kettles, water-baths, etc., there. Fig. 385 represents

FIG. 385.



Eastern side of laboratory.

sents the eastern side, the most prominent object being a work-table, with gas and steam attachments. The retort-stand, shown in Fig. 164, may be used in either of the three holes in the counter, or it may be unscrewed and put away in pieces. Four large drawers and slides are seen in this counter. An adjustable vise might occupy space at one

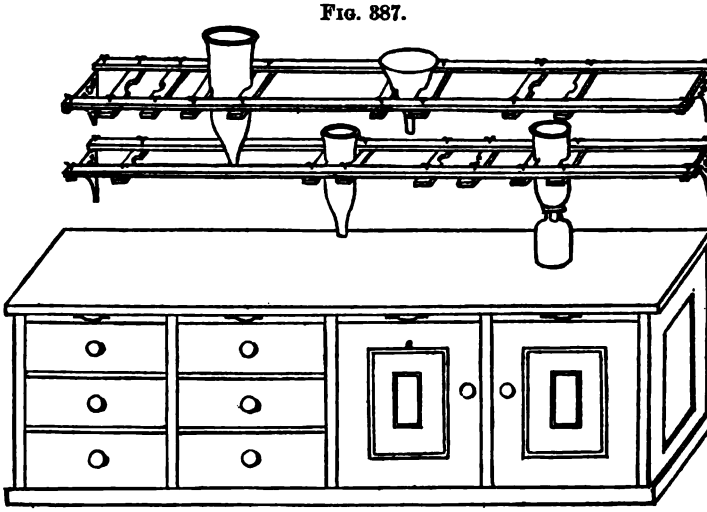
end, and at least one of the drawers should be set apart for tools of general utility, as hatchet, hammer, saw, plane, chisel, etc. The other drawers may contain corks, bladder, twine, spatulas, scoops, glass

Fig. 386.

Southern side of laboratory.

tubing, cork-cutters, etc., and other articles employed in flask operations, small distillations, etc., since this counter will be used for purposes of this kind. Fig. 386 is the counter, with a sheet-lead top, used for chemical work, testing, etc. It should be on the south side, so that the

Fig. 387.



Western side of laboratory.

northern light shall fall directly on it. A small sink at one end will be a convenience. Appropriate drawers, slides, and a closet for holding chemical apparatus are also provided. Fig. 387 represents the phar-

maceutical counter, with the percolating stand (see Fig. 332) above it: two large closets to hold the percolators when not in use, and six drawers, with slides, will complete the arrangement of this counter.

The Cellar.—This usually-neglected locality should receive as much attention as the more favored portions of the store: it should be placed in charge of one or more of the assistants, and the responsibility for keeping it in good order definitely fixed. Good light is generally difficult to obtain, and care is necessary in the use of gas-lights, lanterns, etc. The floor should be of cement, stone, or brick, and, above all, the cellar should be thoroughly drained. Good facilities for lowering and hauling heavy boxes, barrels, and packages should be provided, whilst the stock of prescription-bottles should be kept in covered bins arranged on deep shelves, the doors being hinged from below, and each bin being distinctly labelled with the size of the bottles contained in it. In most stores the heating apparatus, whether it be a furnace or a portable heater, is located in the cellar; and the position of the heater in the cellar will largely determine the proper arrangement of the stock which is kept there. Undoubtedly the most useful feature about the cellar of a pharmacy is the fact that it affords a suitable place for keeping surplus stock, heavy or bulky articles, and those which are perishable if exposed to heat, light, or the too dry atmosphere of the upper rooms.

The stock of mineral waters, or of liquids which are capable of freezing, should be kept near enough to the heater to prevent an accident arising from too low a temperature in winter, whilst ointments, cerates, volatile oils, ethereal and alcoholic liquids, etc., should be placed in the cooler portions of the cellar. If a fire-proof vault made of stone or brick can be provided, it will be found a great convenience for keeping the latter class of preparations. The capacities of the cellar should be made an object of study, and a particularly cool spot should be selected in which to keep the ointments. If this should happen to be in an inconvenient place, or too far away from the steps leading from the store, one of the stock closets in the store may be converted into a dumb-waiter and lowered into a pit dug in the cellar: when an ointment is needed, the dumb-waiter can be easily hauled up, secured, and, after the object is accomplished, lowered into the cooler atmosphere.

The carboys containing acids, etc., are generally regarded as cumbersome and unwieldy objects: they may be stored on skids in the least valuable portion of the cellar. The method of pouring from a carboy is by the use of Stevenson's carboy-rocker (see page 473).

The custom of dispensing carbonated beverages has an advantage which is frequently overlooked,—namely, the fact that the fountains are efficient fire-extinguishers. A line of gas-pipe extending the whole length of the cellar, with suitable outlets, would not be an expensive investment, and yet in case of fire in the cellar it would be easy to form an attachment with a fountain of "soda-water" and thus convey a stream to the locality of the fire. The small portable steel fountains now in use would in many cases do away with the necessity for the length of gas-pipe, for they could be dragged to the fire, and their contents would prove very effective if used in time.

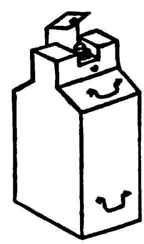
One rule should be rigidly insisted upon in the care of the stock in

the cellar, and that is that when a box of empty bottles or mineral water, or any boxed package, is opened, the contents should be distributed to the bins or places assigned for them, and the empty box and litter immediately removed.

Dampness and mould, which are generally so destructive to the stock kept in the cellar, may be avoided by ventilation. A change of air can always be secured by opening windows in the opposite ends of the cellar, and the musty odors so frequently noticed will rapidly disappear if attention is paid to ventilation.

The stock of liquids is usually kept in demijohns and large green-glass bottles: these should be arranged on shelves, the larger packages on the lower shelves. The wooden-covered glass demijohns and tinned-iron cans, known as transportation cans and demijohns, are very useful in this connection (see Fig. 388). *Great care must be taken, however, in the use of tinned-iron cans for pharmaceutical liquids:* it is not safe to store acid, alkaline, or corrosive liquids in them, nor those containing tannin, on account of their injurious action on the tinned iron. The safest plan is to limit the use of cans to oils, glycerin, fatty bodies, and syrups, which contain nothing capable of acting on the tinned iron. The large containers should be labelled in two ways: the officinal name should be stencilled plainly upon the wooden side which is most prominent, and in addition there should be a tag properly labelled and tied to the handle; upon the reverse side of this tag the date showing when the contents were made, with any other useful notes or data, should be placed. The half-gallon and smaller stock-bottles should be labelled distinctly with large letters: a serviceable label is made by using heavy manilla paper, and instead of an ordinary pen a camel's-hair brush or a piece of pine wood whittled to a flat, stub point like a German-text pen, dipped into black asphalt varnish, may be used to make the letters.

FIG. 388.



Container for stock liquids.

CHAPTER LXIV.

PRESCRIPTIONS.

THE word prescription is derived from the Latin word *præscriptio* (*præ*, "before," and *scribo*, "I write"). It may be defined as the formula which a physician writes, specifying the substances he intends to be administered to a patient.

The Latin language is preferred here in writing prescriptions, as it is also in Great Britain, Germany, and other European countries. The advantages of the use of Latin in designating the ingredients of the prescription are obvious: 1. It is the language of science, and is understood, to a greater or less extent, throughout the civilized world; in addition, it is a dead language, and therefore not subject to the changes that are common to all living forms of speech. 2. The Latin names for medicines are distinctive, and very nearly the same in all countries. 3. It is frequently necessary, and always advisable, to withhold from a patient the names and properties of the medicinal agents administered: this can usually be effected by the use of the Latin technical terms.

The Parts of a Prescription.—For the purpose of examination or study a model prescription may be divided into six parts: 1. *The superscription, or heading.* 2. *The name of the patient.* 3. *The inscription, or the names and quantities of the ingredients.* 4. *The subscription, or the directions to the compounder.* 5. *The signa* (*mark*), *or the directions for the patient.* 6. *The name or initials of the physician, with the date.*

1. The Superscription, or Heading.—This invariably consists, in Latin prescriptions, of the symbol ℞, which is an abbreviation of the word *recipe* ("take"), the imperative of the Latin verb *recipio*. In French prescriptions the letter *P*, the initial letter of the word *prenez* ("take"), is used.

The use of the inclined stroke upon the tail of the ℞ is traced to a custom, common in the ancient days of superstition, of placing at the top of the prescription an abbreviation, called an invocation, which represented a prayer to a favorite deity. The sign of Jupiter (♃), the chief mythological divinity of the ancient Romans, was usually employed. This was gradually replaced by the letter R; but the last stroke of the symbol of the all-powerful Jove has not yet been surrendered, and it remains as an ornament to the superscription to the present day.

2. The Name of the Patient.—This is frequently omitted from the prescription through inattention. It should always be placed at the top of the prescription, and should be transferred to the label by the com-

pounder. Serious accidents have sometimes occurred through neglect of this direction, as when an adult dose of a medicine has been given to a child, owing to the similarity of the appearance of an adult's and a child's medicine, and the name of the patient not appearing on either label.

3. **The Inscription, or the Names and Quantities of the Ingredients.**—This part of the prescription is undoubtedly the most important of all, and requires the greatest amount of care. The officinal names (see page 28) of the ingredients should always be used for designating those which are officinal. A model prescription, if it is of the compound class, is presumed to embrace the following: 1. The *basis*, or chief active ingredient. 2. The *adjuvant*, or aid to the basis, to assist its action. 3. The *corrective*, which is intended to qualify the action of the basis and adjuvant. 4. The *vehicle*, the ingredient which serves to "carry all," or hold them together, dilute them, and give to the whole the proper consistence, form, and color. This is sometimes called the *diluent*.

The ingredients are sometimes written down by the physician in the order given above; but this rule is frequently deviated from, and they follow in the order of their importance. This is a matter of small moment to the pharmacist, however, for he always has to consider solubility, compatibility, and other necessary considerations which determine the order, if the prescription is to be compounded properly.

Many prescriptions contain but one or two ingredients, there being no especial need of a corrective, vehicle, or diluent, the tendency of modern therapeutics being against polypharmacy and in the direction of simple and concentrated remedies, or those having positive effects. There are many advantages to be derived, however, from the combination of ingredients, even when these have similar medicinal action.

The name of each ingredient, and the quantity attached to it, should occupy but one line, and great care should be observed in abbreviating, to see that the abbreviation is distinctive and not liable to be mistaken for an article not intended by the writer. The cabalistic characters in present use, designating the quantities in a Latin prescription, must be very plainly written, if serious errors are to be avoided.

The method of ascertaining the quantities of each of the ingredients generally followed by physicians, is first to write down the names of the ingredients in the proper order, each on a separate line, without affixing the quantities; then having decided upon the total number of doses that are to be given, or the total number of pills, lozenges, capsules, suppositories, etc., by multiplying this by the amount proper to give for the single dose the quantity of the ingredient is obtained.

METHOD OF ALLOTTING QUANTITIES.

Parts in Order.	℞ Ingredients.	No. of Doses.	Multiplied by	Single Dose.	Quantity of each Ingredient.
Basis	Chloralis	16	×	7½ gr.	ʒij
Adjuvant . . .	Potassii Bromidi . .	16	×	15 gr.	ʒiv
Corrective . . .	Syrupi Zingiberis .	16	×	fʒss	f℥i
Vehicle	Syrupi	16	×	fʒiss	f℥iij

Symbolic Characters used in Latin Prescriptions.—Although the subject of weights and measures is treated in the earlier chapters of this work, the special characters used in prescriptions, with their values attached, may be appropriately recalled in this connection: they are as follows:

♏, *Minim*, $\frac{1}{60}$ of a fluidrachm.
gtt., *Gutta*, a drop; plural, *guttæ*, drops.
℈, *Scrupulus*, a scruple (20 grains).[1]
ʒ, *Drachma*, a drachm (60 grains).
fʒ, *Fluidrachma*, a fluidrachm (60 minims).
℥, *Uncia*, a troyounce (480 grains).
f℥, *Fluiduncia*, a fluidounce (8 fluidrachms).
℔, *Libra*, a pound, rarely used (in prescriptions, 5760 grains).
O, *Octarius*, a pint (16 fluidounces).
gr., *Granum*, a grain; plural *grana*, grains.
ss., *Semis*, a half.

The Roman numerals are used to designate quantities,—i, ij, iij, iv, v, vi, vij, viij, ix, x, xx, xxx, xl, l, lx, lxx, lxxx, xc, c, etc. These are always written after the ingredient, as Sacchari ʒiv. Care should be taken to dot the i's in each case, to avoid possible errors.

4. **The Subscription, or the Directions to the Compounder.**—The progress made in pharmacy is well shown by the present custom of omitting specific directions to the compounder. In the vast majority of prescriptions the subscription is contracted to a single letter or word, as *M.*, or *misce*, *S.*, or *solve*, *F.*, *fiat*, etc. The physician relies upon the skill of the pharmacist, and generally gives no specific directions.

5. **The Signa, or Directions for the Patient,** sometimes called Signatura, is usually abbreviated *Sig.* or *S.* Formerly these directions were written in Latin, but this is rarely the case now, except in Great Britain. There is, indeed, no good reason for writing them in Latin. The Latin which is in common use in prescription-writing is idiomatic, and, although the ordinary rules of Latin grammar are generally applicable to it, many of the terms have a special meaning, and it differs in several respects from classical Latin, and hence has to be a special object of study. The directions should be known to the patient, and should be written in the vernacular on the label in a clear, distinct hand. The careless habit of not specifying the directions, by writing "As dir." for "as directed" or "use as directed," is greatly to be deprecated. Frequently the patient forgets the verbal directions, or misunderstands them, and asks the pharmacist, "How is this medicine to be taken?" The answer must of necessity be as worthless as the direction, unless the pharmacist by skilful questioning can cause the directions to be recalled by the patient. Then, again, the dose of the prescription gives the only clue to its safety. Without knowing it, the pharmacist cannot be held responsible for not detecting an error. The patient, even if he remembers at the time the verbal directions, may soon forget them, and afterwards take a double dose by mistake. The directions for the patient should be written in full, explicitly, and in plain English.

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[1] This weight is rapidly passing out of use. It is quite as convenient to write gr. xx, and this is not likely to be mistaken for ʒ, as ℈ is.

6. The Name or Initials of the Physician, with Date.—The name of the prescriber is rarely signed in full, particularly since the very general use of printed prescription-blanks, which contain not only the full name and address of the physician but also his office-hours. It is very necessary sometimes to communicate quickly with the physician in case of error or ambiguity, and, when printed blanks are not used, the name and address of the prescriber should be written in full.

Unusual Doses in Prescriptions.—It is to be regretted that some uniform system of indicating unusual doses has not been adopted by physicians. Occasions frequently arise where the patient, either from becoming habituated to its use, or from some other cause, will tolerate an excessive or ordinarily poisonous dose of a remedy. A careful pharmacist always hesitates to compound such a prescription if the dose is not especially marked as unusual, and delays necessarily occur. The most satisfactory method of indicating such a dose is that of underscoring the quantity deemed unusual, as shown in the following:

℞ Morph. Sulph. gr. vi;
Syrup. Limonis fʒij;
Aquæ q. s. ft. f℥i.
Sig. A teaspoonful every two hours until relieved.

Other marks are sometimes used,—the exclamation-mark (!), for instance, or Q. R. (*quantum rectum*). These are not so distinctive as underscoring, and are open to the objection that in handwriting, which is very apt to be defective, they are likely to puzzle or mislead the pharmacist by being mistaken for some other parts of the prescription. A heavy black line under the unusual dose cannot be mistaken.

One of the best works recently published upon prescription Latin is the Latin Grammar of Pharmacy, by Joseph Ince, London. The student will be well repaid by a careful perusal. The following Latin prescription from Whitla's Elements, with the grammatical analysis, is so thoroughly illustrative that it is inserted in its entirety.

℞ . . . . SUPERSCRIPTION.
(Basis.) *Pot. Acet.* ʒv.
(Adjuvant.) *Tinct. Digitalis* ʒj.
(Corrective.) *Syr. Aurantii* ℥j.
(Vehicle.) *Decoct. Scoparii ad* ℥viij.
} INSCRIPTION.
M., ft. mist. . . . . SUBSCRIPTION.
Cpt. cochl. mag. ii. 4ta q.q. hora ex paul. aquæ. SIGNA.

Without abbreviations or contractions it would read thus:

Recipe
Potassæ Acetatis drachmas quinque.
Tincturæ Digitalis drachmam unam.
Syrupi Aurantii unciam unam.
Decocti Scoparii ad uncias octo.
Misce, fiat mistura. *Capiat cochlearia duo magna quarta quâque horâ ex paululo aquæ.*

The student will find benefit from a careful study of the following page, in which the Latin of the above prescription is arranged according to the English idiom, and each word parsed and translated.

Recipe Potassæ Acetatis drachmas quinque.

℞ (Recipe).	v. irr. tr. imp. m. 2d per. s., to agree with its nom. Tu—"thou" (understood). Recipi-o, recepi, receptum, recipere. From re and capio.	Take thou
v (quinque).	num. adj. indec. ac. pl. qual. and agreeing with drachmas.	five
ʒ (drachmas).	n. f. ac. pl. Drachma, -æ.	drachms.
Acet. (acetatis).	n. f. gen. s. qual. drachmas. Acetas, -atis.	of acetate
Pot. (potassæ).	n. f. gen. s. qual. acetatis. Potassa, -æ.	of potash.

Recipe Digitalis Tincturæ drachmam unam.

℞ (Recipe).	(understood.)	Take thou
j (unam).	num. adj. ac. s. qual. and agreeing with drachmam. Unus, -a, -um.	one
ʒ (drachmam).	n. f. ac. s. gov. by recipe. Drachma, -æ.	drachm.
Tinct. (tincturæ).	n. f. gen. s. qual. drachmam. Tinctura, -æ.	of the tincture
Digit. (digitalis).	n. f. gen. s. qual. tincturæ. Digitalis, -is.	of digitalis.

Recipe Aurantii Syrupi unciam unam.

℞ (Recipe).	(understood.)	Take thou
j (unam).	(Parsed as before.)	one
℥ (unciam).	n. f. ac. s. gov. by recipe. Uncia, -æ.	ounce
Syr. (syrupi).	n. m. gen. s. qual. unciam. Syrupus, -i.	of syrup
Aur. (aurantii).	n. neut. gen. s. qual. syrupi. Aurantium, -ii.	of orange peel.

Recipe Decocti Scoparii ad uncias octo.

℞ (Recipe).	(understood.)	Take thou
Ad.	prep. used adverbially.	up to
viij (octo).	num. adj. indec. qual. uncias.	eight
℥ (uncias).	n. f. ac. pl. gov. by recipe. Uncia, -æ.	ounces
Decoct.[1] (decocti).	n. neut. gen. s. qual. uncias. Decoctum, -i.	of the decoction
Scop. (scoparii).	n. masc. gen. s. qual. decocti. Scoparius, -ii.	of broom.

Misce, fiat mistura.

M. (misce).	v. trans. imp. m. p. t., agreeing with and governed by Tu (understood). Misceo, -ui, mixtum or mistum, miscere.	Mix you, or mix.
Mist. (mistura).	n. f. nom. s., governing fiat. Mistura, -æ.	Let the mixture
Ft. (fiat).	v. used as passive of facio, pres. sub. 3d s. Used as imp. gov. by and agreeing with mistura. Fio, factus sum, fieri; to be made or become.	be made.

Capiat cochlearia duo magna quartâ quâque horâ ex paululo aquæ.

Cpt. (capiat).	irr. v. tr. sub. m. pr. t. 3d per. s., agreeing with and gov. by Is—"he" (understood). Capio, cepi, captum, capere, the present subjunctive used as an imperative.	He may take, or let him take,
ij (duo).	num. adj. ac. pl. neut. qual. and agreeing with cochlearia. Duo, -æ, -o.	two
Mag. (magna).	adj. ac. pl. neut. qual. and agreeing with cochlearia. Magnus, -a, -um.	large
Coch. (cochlearia).	n. ac. pl. neut., gov. by capiat. Cochleare, -is.	tablespoonfuls
q.q. (quâque).	pron. indef. abl. s., qualifying and agreeing with horâ. Quisque, quæque, quodque.	at each
4ta (quarta).	num. adj. abl. s., qualifying and agreeing with horâ. Quartus, -a, -um.	fourth
Horâ.	n. f. abl. s. Hora, -æ.	hour
Ex.	prep.	out of
Paul. (paululo).	adj. abl. s. Used as a noun, gov. by ex. Paululus, -a, -um.	a little
Aq. (Aquæ).	n. f. gen. s. qual. paululo. Aqua, -æ.	of water.

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[1] Some authorities would put Decoct. in the accusative, governed by recipe. In the same way, where the student meets Aquæ ad ℥ in the different prescriptions and formulæ throughout this work, he may substitute Aquam ad ℥; but this latter is by no means so idiomatic as Aquæ ad ℥.

Abbreviations are necessary in writing prescriptions, and they are universally employed. Great care must be taken, however, to avoid ambiguities, which may mean death to the patient. Usually, the careful pharmacist gathers from the directions and the quantities the information which guides him into safety. A few examples of defective abbreviations are appended, a number of which are taken from Pareira's Physician's Prescription-Book.

Acid. Hydroc.	May mean Acidum Hydrochloricum or Acidum Hydrocyanicum.
Aconit.	Aconitine. Aconiti Radix. Aconiti Folia.
Ammon.	Ammonia (alkali). Ammoniac (gum-resin).
Aq. Chlor.	Aqua Chlori. Aqua Chloroformi.
Aq. Fontis.	May often be read Aqua Fortis.
Calc. Chlor.	Calcium Chloride. Chlorinated Lime.
Chlor.	Chlorine. Chloroform. Chloral.
Emp. Lyt.	Emp. Lytharg. (lead plaster,—old name). Emp. Lyttæ (blistering plaster).
Ext. Col.	Extractum Colchici. Extractum Colocynthidis.
Hyd. Chlor.	Calomel. Corrosive Sublimate. Chloral Hydrate.
Hydr.	Hydrargyrum (mercury). Hydras (hydrate). Hydriodas (hydriodate). Hydrochloras (hydrochlorate). Hydrocyanas (hydrocyanate).
Hydr. Perox.	Hydrogen Peroxide. Hydrargyri Peroxidum.
Mist. Ammon.	Ammonia Mixture. Mixture of Ammoniac (gum-resin).
Potass. Hyd.	Potassium Hydrate (caustic potassa). Potassium Hydriodate (iodide of potassium).
Sod. Hypo.	Sodium Hyposulphite. Sodium Hypophosphite.
Sod. Sulph.	Sodium Sulphate. Sodium Sulphite. Sodium Sulphide.
Sulph.	Sulphur. Sulphide. Sulphate. Sulphite.
Zinci Phosph.	Zinc Phosphate. Zinc Phosphide.

The above list might be indefinitely prolonged. Sufficient has been clearly shown, however, to convince even the most sceptical practitioner of the grave danger of careless abbreviation. The following table of abbreviations, terms, etc., used in prescriptions will be of service to the pharmacist, by enabling him to translate some of the technical phrases used in writing prescriptions:

Word or Phrase.	Contraction.	Meaning.	Word or Phrase.	Contraction.	Meaning.
A, āā		Of each.	Adjacens	Adjac.	Adjacent.
Abdomen	Abdom.	The belly.	Ad libitum	Ad lib.	At pleasure.
Absente febre	Abs. febr.	In the absence of fever.	Admove, admoveatur, admoveantur	Admov.	Apply, let it be applied, let them be applied.
Accurate		Accurately.	Adstante febre	Adst. febre.	When the fever is on.
Ad	Ad	To, up to.	Adversum	Adv.	Against.
Ad duas vices	Ad 2 vic.	At twice taking.	Aggrediente febre	Aggred. febre.	While the fever is coming on.
Ad secundum vicem		To the second time.	Agitato vase		The vial being shaken.
Ad tertiam vicem		For three times.	Aliquot		Some.
Adde, or addantur, addendus, addendo	Ad. or add.	Add, or let them be added, to be added, by adding.	Alter		The other.
Ad defectionem animi	Ad def. animi.	To fainting.	Alternis horis		Every other hour.
Ad gratam aciditatem	Ad grat. acid.	To an agreeable sourness.	Aluta		Leather.
Adhibendus		To be administered.	Alvo adstricta	Alv. adst.	The bowels being confined.
			Alvus		The belly.
			Amplus		Large.

Word or Phrase.	Contraction.	Meaning.
Ana	A., āā.	Of each.
Aqua	Aq.	Water.
Aqua astricta	Aq. astr.	Frozen water.
Aqua bulliens	Aq. bull.	Boiling water.
Aqua communis	Aq. comm.	Common water.
Aqua fervens	Aq. ferv.'	Hot water.
Aqua fluviatilis	Aq. fluv.	River water.
Aqua fontalis (or fontis or fontana)	Aq. font.	Spring water.
Aqua marina	Aq. mar.	Sea water.
Aqua nivalis	Aq. niv.	Snow water.
Aqua pluviatilis (or pluvialis)	Aq. pluv.	Rain water.
Aut		Or.
Balneum arenæ	B. A.	Sand-bath.
Balneum mariæ or maris	B. M.	A salt-water bath.
Balneum vaporosum or vaporis	B. V.	A vapor-bath.
Balsamum	Bals.	Balsam.
Barbadensis	B.B., B.B.S.	Barbadoes.
Bene		Well.
Bibe	Bib.	Drink.
Biduum		Two days.
Bis		Twice.
Bis in die	Bis in d.	Twice a day.
Bis indies	Bis in d.	Twice a day.
Bolus	Bol.	A large pill.
Bulliat, bulliant	Bull.	Let boil.
Butyrum	But.	Butter.
Cæruleus	Cærul.	Blue.
Calefactus		Warmed.
Calomel	Cal.	Mild chloride of mercury.
Calomelas		Calomel, or mild chloride of mercury.
Capiat	Cap.	Let him (or her) take.
Caute		Cautiously.
Charta	Chart.	Paper.
Chartula		Small paper.
Cibus		Food.
Cochlear or cochleare, Cochleatim	Coch., Cochleat.	A spoonful, by spoonfuls.
Cochleare amplum	Coch. amp.	A tablespoonful.
Cochleare magnum	Coch. mag.	A large spoonful (about half an ounce).
Cochleare medium or modicum	Coch. med.	A dessertspoonful (about two fluidrachms).
Cochleare parvum	Coch. parv.	A teaspoonful (about one fluidrachm).
Coctio	Coct.	Boiling.
Cola	Col.	Strain.

Word or Phrase.	Contraction.	Meaning.
Colaturæ	Colatur.	To, or of, the strained liquor.
Colatus	Colat.	Strained.
Coletur	Colet.	Let it be strained.
Colentur	Colent.	Let them be strained.
Collutorium	Collut.	A mouth-wash.
Collyrium	Collyr., Coll.	An eye-wash.
Coloretur		Let it be colored.
Compositus	Comp.	Compounded.
Concisus		Cut.
Confectio	Conf.	Confection.
Congius	Cong.	A gallon.
Conserva	Cons.	A conserve; also keep (thou).
Continuantur remedia	Cont. rem.	Let the medicines be continued.
Contusus		Bruised.
Coque, Coquantur	Coq.	Boil, let them be boiled.
Coque ad medietatis consumptionem	Coq. ad med. consump.	Boil to the consumption of half.
Coque secundum artem	Coq. S. A.	Boil according to art.
Coque in sufficiente quantitate aquæ	Coq. in S. A.	Boil in a sufficient quantity of water.
Cor, cordis		The heart.
Cortex	Cort.	The bark.
Coxa		The hip.
Cras, Crastinus	Crast.	To-morrow.
Cras mane sumendus		To be taken to-morrow morning.
Cras nocte		To-morrow night.
Cras vespere		To-morrow evening.
Crastinus		For to-morrow, early.
Cujus, Cujuslibet	Cuj.	Of which, of any.
Cum	C.	With.
Cyatho theæ		In a cup of tea.
Cyathus, vel Cyathus vinarius	Cyath., C. vinar.	A wineglass, from one-half to two fluidounces.
Da, detur	D., det.	Give, let be given.
De		Of, or from.
Deaurentur pilulæ	Deaur. pil.	Let the pills be gilt.
Debita spissitudo	Deb. spiss.	A proper consistence.
Debitus		Due, proper.
Decanta	Dec.	Pour off.
Decem, Decimus		Ten, the tenth.
Decoctum	Decoct.	A decoction.
Decubitus	Decub.	Lying down.
De die in diem	De d. in d.	From day to day.
Dein		Thereupon.
Deglutiatur	Deglut.	May or let be swallowed.
Dentur tales doses No. iv	D. t. d. No. iv.	Let 4 such doses be given.

Word or Phrase.	Contraction.	Meaning.
Detur in duplo		Let twice as much be given.
Dexter, Dextra		The right.
Diebus alternis	Dieb. alt.	Every other day.
Diebus tertiis	Dieb. tert.	Every third day.
Diluculo	Diluc.	At break of day.
Dilue, Dilutus	Dil.	Dilute (thou), diluted.
Dimidius	Dim.	One-half.
Directione propriâ	D. P. or direc. prop.	With a proper direction.
Dividatur in partes æquales	D. in p. æq.	Let it be divided into equal parts.
Dividendus, -a, -um		To be divided.
Dolor		Pain.
Donec		Until.
Donec alvus bis dejiciatur		Until the bowels have been twice evacuated.
Donec alvus soluta fuerit		Until the bowels shall be opened.
Donec dolor nephriticus exulaverit		Until the nephritic pain is removed.
Dosis	D.	A dose.
Durante dolore		While the pain lasts.
Eadem (fem.)		The same.
Eburneus	Eburn.	Made of ivory.
Edulcorata	Ed.	Edulcorated.
Ejusdem	Ejusd.	Of the same.
Electuarium	Elect.	An electuary.
Emesis		Vomiting.
Enema	En.	An enema, a clyster.
Enemata		Clysters.
Et		And.
Evanuerit		Shall have disappeared.
Exhibeatur	Exhib.	Let it be exhibited.
Extende	Ext.	Spread.
Extende super alutam mollem	Ex. sup. alut. moll.	Spread thou upon soft leather.
Extractum	Extr.	An extract.
Fac, Fiat, Fiant	F., Ft.	Make, let it be made, let them be made.
Fac pilulas duodecim	F. pil. xij.	Make 12 pills.
Farina		Flour.
Fasciculus		A bundle which can be carried under the arm.
Febre durante	Feb. dur.	During the fever.
Febris		Fever.
Femoribus internis	Fem. intern.	To the inner parts of the thighs.
Fervens	Ferv.	Boiling.
Fiat cataplasma	Ft. cataplasm.	Make a poultice.
Fiat ceratum	Ft. cerat.	Make a cerate.

Word or Phrase.	Contraction.	Meaning.
Fiant chartulæ xij	Ft. chart. xij.	Make 12 powders.
Fiat collyrium	Ft. collyr.	Make an eye-wash.
Fiat confectio	Ft. confec.	Make a confection.
Fiat electuarium	Ft. elect.	Make an electuary.
Fiat emplastrum 6×4	Ft. emp. 6×4.	Make a plaster 6 by 4 inches.
Fiat emplastrum epispasticum	Ft. emp. epispast.	Make a blister.
Fiat emplastrum vesicatorium	Ft. emp. vesicat.	
Fiat emulsio	Ft. emuls.	Make an emulsion.
Fiat enema	Ft. enema.	Make an injection (for rectum).
Fiat gargarisma	Ft. garg.	Make a gargle.
Fiat haustus	Ft. haust.	Make a draught.
Fiat infusum	Ft. infus.	Make an infusion.
Fiat injectio	Ft. inject.	Make an injection (for urethra).
Fiat lege artis	F. L. A.	Let it be made by the rules of art.
Fiat linimentum	Ft. linim.	Make a liniment.
Fiat massa	Ft. massa.	Make a mass.
Fiat massa et divide in pilulas xij	Ft. mas. div. in pil. xij.	Make 12 pills.
Fiat massa in pilulas xij dividenda	Ft. mas. div. in pil. xij.	
Fiat massa in trochiscos xl dividenda	Ft. mas. in troch. xl div.	Make 40 lozenges
Fiat mistura	Ft. mist.	Make a mixture.
Fiant pilulæ xij	Ft. pil. xij.	Make 12 pills.
Fiat pulvis	Ft. pulv.	Make a powder.
Fiant pulveres xij	Ft. pulv. xij.	Make 12 powders.
Fiat pulvis et divide in chartulas xij	Ft. pulv. et div. in char. xij.	
Fiat pulvis in chartulas xij dividenda		
Fiat secundum artis regulas	F. S. A. R.	Let it be made according to the rules of art.
Fiat solutio	Ft. solut.	Make a solution.
Fiat suppositorium	Ft. suppos.	Make a suppository.
Fiant suppositoria iv	Ft. suppos. iv.	Make 4 suppositories.
Fiat trochisci xxiv	Ft. troch. xxiv.	Make 24 lozenges.
Fiat unguentum	Ft. ung.	Make an ointment.
Fiat venæsectio		Bleed.

Word or Phrase.	Contraction.	Meaning.
Fictilis		Earthen.
Filtra		Filter (thou).
Filtram, Filtrum		A filter.
Fistula armata		A syringe fitted for use.
Fluidus	Fl.	Liquid.
Formula		A prescription.
Frustillatim	Frust.	In little pieces.
Fuerit		Shall have been.
Gargarisma	Garg.	A gargle.
Gelatinâ quâvis		In any kind of jelly.
Gradatim		By degrees, gradually.
Grana sex pondere		Six grains by weight.
Granum, Grana		Grain, grains.
Gratus		Pleasant.
Gutta	Gtt.	A drop.
Guttæ	Gtt.	Drops.
Guttatim	Guttat.	By drops.
Guttis quibusdam	Gutt. quibusd.	With a few drops.
Harum pilularum sumantur tres	Har. pil. sum. iij.	Let three of these pills be taken.
Haustus	Haust.	A draught.
Haustus purgans noster	H. p. n.	A purging draught made according to a practitioner's own formula.
Hebdomada		A week.
Herba		An herb.
Heri		Yesterday.
Hic, Hæc, Hoc		This.
Hirudo		A leech.
Hora	H.	An hour.
Horâ somni	H. S. or Hor. som.	Just before going to sleep, or on retiring to rest.
Horâ undecimâ matutinâ		At the eleventh hour of the morning.
Horâ decubitûs	H. D.	At the hour of going to bed.
Horæ unius spatio	Hor. un. spatio.	At the expiration of an hour.
Horis intermediis	Hor. interm.	In the intermediate hours.
Idem		The same.
Idoneus		Proper.
Imprimis		First.
Incide, Incisus	Inc.	Cut (thou), being cut.
Indies	Ind.	From day to day, daily.
Infunde	Inf.	Pour in.
Infusum	Infus.	An infusion.
Injectio		An injection.
Injiciatur enema		Let a clyster be given.
In pulmento		In gruel.
Instar		As big as.

Word or Phrase.	Contraction.	Meaning.
Inter		Between.
Internus		Inner.
Jam		Now.
Jentaculum	Jent.	Breakfast.
Julepus, Julepum	Jul.	A julep.
Jusculum		A broth.
Juxta		Near to.
Kali præparatum (potassæ carbonas)	Kal. ppt.	Prepared kali, or carbonate or bicarbonate of potash.
Lac		Milk.
Lana		Flannel.
Languor		Faintness.
Lateri dolenti	Lat. dol.	To the side that is painful.
Lectus		A bed.
Linimentum	Liniment.	A liniment.
Linteum		Lint.
Liquor	Liq.	A solution.
Lotio		A lotion.
Macera	Mac.	Macerate.
Magnus	Mag.	Large.
Mane, Mane primo		In the morning, very early in the morning.
Manipulus	M. or Man.	A handful.
Manus		The hand.
Massa, Massa pilularis		A mass, a pill-mass.
Matutinus		In the morning.
Medius		Middle.
Mensura		By measure.
Mica panis	Mic. pan.	Crumb of bread.
Minimum	M. or Min.	A minim.
Minutum		A minute.
Misce	M.	Mix.
Mistura	Mist.	A mixture.
Mitte, Mittatur, Mittantur		Send, let it be sent, let them be sent.
Mitte sanguinem ad uncias duodecim saltem		Take away blood to 12 ounces at least.
Modicus		Middle-sized.
Modo præscripto	Mod. præsc.	In the manner prescribed.
Mora		Delay.
More dictu, More solito	More dict., More sol.	In the manner directed, in the usual manner.
Mortarium		A mortar.
Ne tradas sine nummo	Ne tr. s. num.	Do not deliver it unless paid. (Used by apothecaries as a caution to the assistant when the presence of the patient prevents the master from giving a verbal direction.)
Necnon		Also.
Nisi		Unless.

Word or Phrase.	Contraction.	Meaning.
Non		Not.
Nox, noctis		Night.
Nucha		The nape of the neck.
Numerus	No	Number.
Nux Moschata		A nutmeg.
Octarius	O.	A pint.
Octavus		Eighth.
Octo		Eight.
Oleum lini sine igne		Cold-drawn linseed oil.
Oleum olivæ optimum	O. O. O.	Best olive oil.
Omni horâ, Omni bihorio, Omni quadrante horæ	Omn. hor., Omn. bih., Omn. quadr. hor.	Every hour, every two hours, every quarter of an hour.
Omni mane		Every morning.
Omni nocte		Every night.
Opus		Need, occasion.
Ovum		An egg.
Pannus		A rag.
Pars, partis		A part.
Partes æquales	P. æ.	Equal parts.
Partitis vicibus	Part. vic.	In divided doses.
Parvulus		An infant.
Coch. parvulum	Coch. parv.	A teaspoonful.
Parvus		Little.
Pastillus, Pastillum		A little ball of paste, to take like a lozenge, etc.
Pediluvium		A foot-bath.
Per		Through, by.
Peractâ operatio emetici		When the operation of the emetic is finished.
Per deliquium		By deliquescence.
Pergo, pergere		To go on with.
Phiala prius agitata	P. P. A.	The bottle having been first shaken.
Pilula		A pill.
Poculum, Pocillum	Pocul., Pocill.	A cup, a little cup.
Pondere	P.	By weight.
Pondus civile		Civil weight (avoirdupois weight).
Pondus medicinale		Medicinal (apothecaries') weight
Pone aurem		Behind the ear.
Post singulas sedes liquidas		After every loose stool.
Potus		Drink.
Præparata		Prepared.
Prandium	Prand.	Dinner.
Primo mane		Very early in the morning.
Primus		The first.
Pro		For.
Pro ratione ætatis		According to the age of the patient.
Pro re nata	P. r. n.	Occasionally.
Pugillus	Pug.	A pinch, a gripe between the thumb and first two fingers.
Pulvis, Pulverizatus	Pulv.	A powder, powdered.
Pyxis		A pill-box.
Quantum libet, or Quantum placet, or Quantum vis, or Quantum volueris	Q. l., Q. p., Q. v.	As much as you please.
Quantum sufficiat, or Quantum satis	Q. s.	As much as is sufficient.
Quâquâ horâ		Each hour.
Quaque,	Q. Q.	Each or every.
Quaque horâ		Each hour.
Quartus		Fourth.
Quater		Four times.
Quatuor		Four.
Quibus		From which.
Quinque		Five.
Quintus		The fifth.
Quoque	Q. Q.	Also.
Quorum	Quor.	Of which.
Quotidie		Daily.
Ratio		Proportion.
Recens	Rec.	Fresh.
Recipe	℞	Take.
Redactus in pulverem, redigatur in pulverem	Red. in pulv., redig. in pulv.	Let it be reduced to powder.
Regio umbilici		The umbilical region.
Reliquus		Remaining.
Repetatur, Repetantur	Rept.	Let it be repeated, let them be repeated.
Respondere		To answer.
Retinere		To keep.
Saltem		At least.
Scatula	Scat.	A box.
Scilicet		Namely.
Secundum artem, Secundum naturam	S. A., S. N.	According to art, according to nature.
Secundus		Second.
Sedes		The alvine evacuation.
Semel		Once.
Semis	Ss.	A half.
Semidrachma	Semidr.	Half a drachm.
Semihora	Semih.	Half an hour.
Septem		Seven.
Septimana		A week.

Word or Phrase.	Contraction.	Meaning.
Sescuncia		An ounce and a half.
Sesquihora		An hour and a half.
Sex		Six.
Sextus		Sixth.
Si		If.
Sic, Sic?		So, is it so?
Signa	Sig.	Mark thou.
Signetur nomine proprio		Let it be written upon with the proper name(not a trade name).
Simul		Together.
Sine		Without.
Singulorum	Sing.	Of each.
Si non valeat	Si n. val.	If it does not answer.
Si opus sit	Si op. sit.	If necessary.
Si vires permittant	Si vir. perm.	If the strength will bear it.
Sit		Let it be.
Solus		Alone.
Solve		Dissolve.
Solvo, solvere,		To dissolve.
Solutus		Dissolved.
Somnus		Sleep.
Spiritus vini rectificatus		Rectified spirit of wine.
Spiritus vini tenuis		Proof spirit.
Spiritus vinosus		Ardent spirit of any strength.
Statim	Stat.	Immediately.
Stet, Stent	St.	Let it stand, let them stand.
Stratum super stratum	S. S. S.	Layer upon layer.
Subactus		Subdued.
Sub finem coctionis		When the boiling is nearly finished.
Subinde.		Frequently.
Sumat talem		Let the patient take one like this.
Sume, Sumat, Sumatur, Sumantur, Sumendus	Sum.	Take (thou), let him take, let it be taken, let them be taken, to be taken.

Word or Phrase.	Contraction.	Meaning.
Summitates		The summits or tops.
Superbibendo haustum		Drinking afterwards this draught.
Supra		Above.
Tabella (dim. of tabula, a table)	Tabel.	A lozenge.
Talis		Such, like this.
Tempori dextro		To the right temple.
Tempus, temporis		Time or temple.
Ter		Three times.
Ter in die, or Ter die.	T. i. d., or t. d.	Three times a day.
Tere	Ter.	Rub.
Tero		I rub.
Tertius		Third.
Tinctura	Tinct.	Tincture.
Tres		Three.
Triduum		Three days.
Tritura	Trit.	Triturate.
Trochisci	Troch.	Lozenges.
Tussis		A cough.
Ultimo (or Ultima) præscriptus	Ult. præsc.	The last ordered.
Una		Together.
Uncia		An ounce.
Ut dictum	Ut dict.	As directed.
Utendum	Utend.	To be used.
Uto, uti		To make use of.
Vas vitreum		A glass vessel.
Vehiculum		A vehicle.
Vel		Or.
Venæsectio brachii		Bleeding in the arm.
Vesper, vesperis	Vesp.	The evening.
Vices		Turns.
Vires		Strength.
Vitellus		Yolk.
Vitello ovi solutus		Dissolved in the yolk of an egg.
Vitreum vitrum		Glass.
Vomitione urgente	Vom. urg.	The vomiting being troublesome.

AUTOGRAPH AND QUESTIONABLE PRESCRIPTIONS.

In the following pages will be found fac-similes of prescriptions taken from the author's collection. One of the most important duties of the pharmacist is the unravelling of prescriptions, and upon his cleverness in accurately divining the intention of the physician will often depend his reputation for skill and ability. It may be found that as one's experience in the art of interpreting increases, that there will be ample justification and respect for the philologist who dignified the art of writing prescriptions by such a massive word as "Pharmacocatagraphologia." It is not to be supposed that all of the prescriptions which

follow are of a character which would prove stumbling-blocks to those having had experience in this difficult art; indeed, the author has the highest regard for the rare sagacity possessed by the American pharmacist, who has an international reputation for acuteness, and his only apology for presenting them is that he has some hope of aiding the younger members by some useful practice.

It should be noted that the fac-simile prescriptions in the following pages, whilst faithful reproductions, are really clearer and are usually easier to read than the originals, because it has been found impossible to reproduce blurred lead-pencil marks, greasy spots, finger marks, and the crumpled paper, which are such important aids in obscuring the legibility of every-day prescriptions.

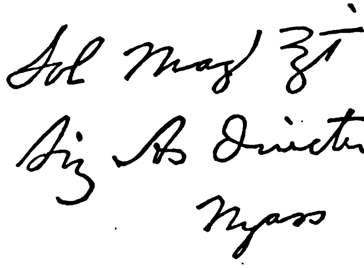
The succeeding illustrations are all that we have space for: they show the importance of writing prescriptions upon regularly printed or engraved blanks, on which the name of the physician is clearly shown, with his office hours and address, in order that the pharmacist in case of necessity may confer with him speedily and have all doubts removed about the interpretation of the prescription.

Omissions and Errors.—If an *obvious* error or omission is detected by the pharmacist, or an unusually large or poisonous dose has been prescribed, it is generally easy to gain the requisite delay, upon the plea that the prescription will require considerable time to compound, or for some other reason which will not excite the suspicions of the patient, and in the mean time the physician may be consulted and the difficulty removed. Good judgment is necessary at all times, and where delay is entirely inadmissible there is nothing left for the pharmacist but to assume the responsibility of making the dose safe, or of supplying the omission according to his best judgment. In this case a written explanation should be sent immediately to the physician.

In the case of omissions or errors on the part of the pharmacist, so much judgment is needed which must depend upon the circumstances surrounding each case, that it would be unsafe to offer any suggestions: generally the physician must be appealed to, and upon his skill and tact reliance must be placed. In such cases it is not often that he is found unwilling to exercise his good offices. One instance is on record showing rare tact on the part of an apothecary: it occurred before the practice of checking prescriptions became common. After renewing a mixture, he realized, just as he was in the act of handing the bottle to the nervous and suspicious old gentleman for whom it was intended, that he had omitted one of the principal ingredients: to hand it to him and permit his departure would have been professional suicide, to hesitate and take it back after the patient had watched the process of compounding, and had seen the bottle labelled and wrapped, would have excited unpleasant suspicions and have been equally disastrous. At once grasping the situation, he dropped the bottle upon the counter, allowing it to break to pieces, whilst in the act of handing it to the patient, then, with an apology for the accident, he quickly proceeded to compound the mixture over again, this time with every ingredient in it. He fully believed that any proper sacrifice should be cheerfully made to avoid loss of confidence.

Fig. 889 is a good representation of a class of prescriptions far too common in every-day practice. If taken by a patient to a pharmacy where the habit and handwriting of the physician are not known it would prove a veritable puzzle. The first thought of the compounder will naturally be solution of magnesia; then the absence of directions will cause him to stop and consider. He may then run over in his mind the numerous solutions of magnesia with which he is familiar and possibly select one of the most harmless; then, choosing the best course, he asks the patient, in a matter-of-fact way, whether the doctor left any directions how the medicine was to be used. "Oh, yes, with a syringe." More puzzled now than ever, but not showing to the patient the slightest embarrassment, he suddenly catches the idea that Magendie's solution of morphine is to be used hypodermically. A few more skilful questions remove all doubt, and the patient hastens away convinced that the apothecary is careful, and never suspects that faulty abbreviation and a worse fault in writing the directions on the part of the physician have given the pharmacist one more reason to lament his serious want of care.

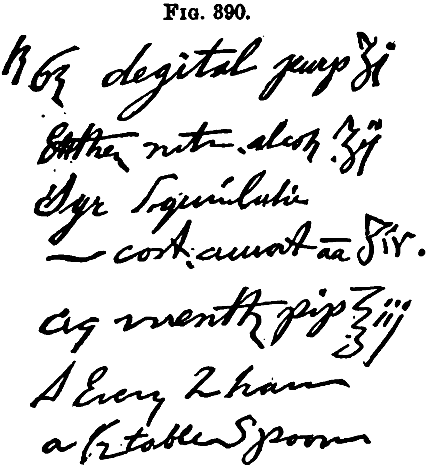
FIG. 889.



Questionable prescription.

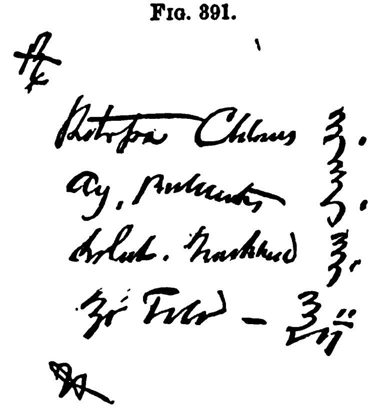
The writer displays a lack of education by prescription 890, although there are no particular difficulties in compounding it. "Tr. degital purp" would be easily rendered by an experienced compounder tincture of digitalis. "Eather nitr. alcoh" would become spirit of nitrous ether. The next ingredient would be apt to puzzle the uninitiated, but any one familiar with German prescriptions would have no difficulty in selecting syrup of liquorice as the article wanted, "Syr. Liquiritiæ" being the common term for it. The bad habit of using a dash to signify "the same," in

FIG. 890.



Faulty prescription.

FIG. 891.



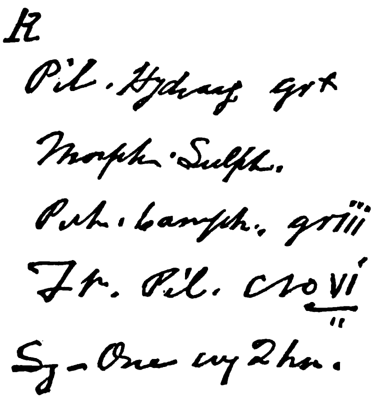
Carelessly-written prescription.

place of a ditto-mark, is not thoroughly established in this country, although there would be no great difficulty in guessing at the prescriber's meaning. The use of either ditto-marks or dashes in prescription-writing is a practice more honored in the breach than in the observance by careful prescribers. The unusual order in which the quantity in the "Signa" appears betrays the nationality of the writer,—"Every 2 hours a ½ table spoon,"—although it would be easily understood to mean, Take a dessertspoonful every two hours.

Prescription 891 has proved a puzzle to many expert pharmacists. The bad habit of running the quantities into one another, the equally bad taste shown in using

both English and Latin in the same prescription, and the exhibition of gross carelessness about the whole composition, make it a unique specimen. The original in the author's possession was written with a very soft lead-pencil, and is considerably blurred. One drachm of chlorate of potassium is to be dissolved in one ounce of boiling water, one ounce of solution of morphine, and two ounces of syrup of tolu. The dots which should be over the numerals representing 1's have so strayed from their legitimate use as to have lost their identity entirely, and the third line is almost unrecognizable. One would suppose that its dangerous character would have saved it from such a fate.

Fig. 892.

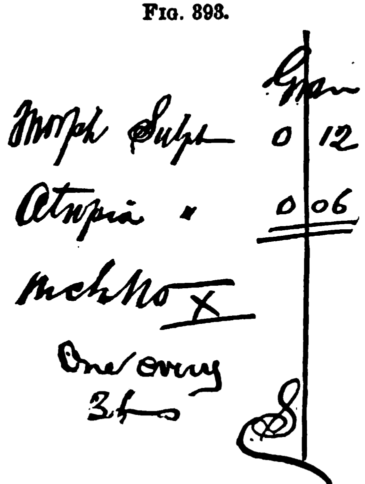


Faulty prescription.

Prescription 892 illustrates a common fault,—an omitted quantity. It has evidently been written for a patient suffering some pain, and has been designed for immediate use. Of course such a prescription should be instantly returned to the prescriber, the pharmacist gaining time by stating to the patient that it will take some time to compound it. If, however, there is great urgency, the physician not being accessible, and the pharmacist is prepared to assume the risks which such a course entails, one grain of morphine sulphate may be used if the patient is an adult and able to bear it, as it is strongly probable that the intention of the prescriber was to give one-sixth of a grain as a dose. This course is not recommended, however, as one to be followed by the pharmacist, except in rare emergencies, and the physician should be notified at once of the facts.

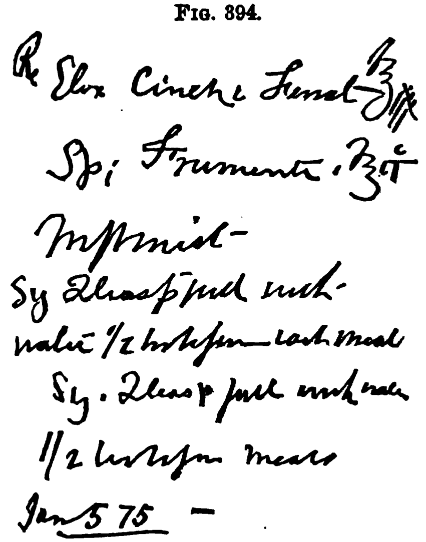
Fig. 893 is an exact reproduction of a prescription presented in the ordinary course of business. It was written by a young physician who had become enamoured of

Fig. 893.



Dangerous prescription.

Fig. 894.



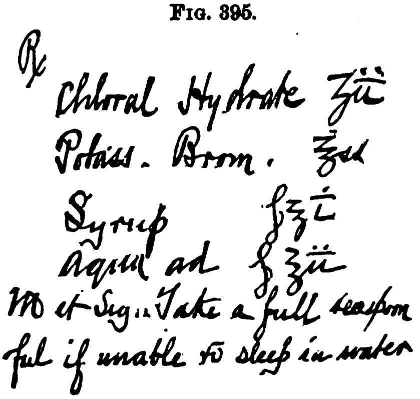
Double direction prescription.

European methods, but had not sufficiently mastered the intricacies of the metric system to be sure of his doses. A dose of six centigrammes (about nine-tenths of a grain) of atropine sulphate was ninety times larger than he intended to give to

the patient. In this case the prescription was held until amended, and the proverbial caution of the pharmacist saved the patient's life and probably the physician's reputation.

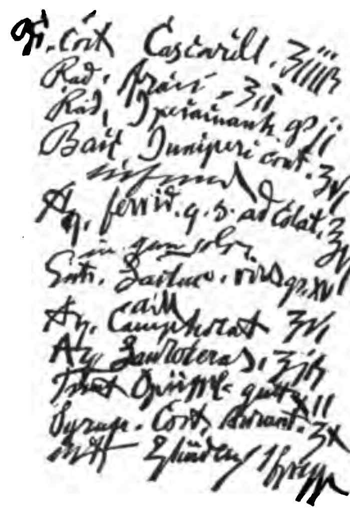
Prescription 394 is a fac-simile of one written by a celebrated physician of Philadelphia. In all probability no greater difficulty was experienced in compounding the prescription than was found by the patient in taking it. It is rather unusual to duplicate the signa, however, and the high character of the physician precludes the possibility of there being any truth in the suggestion of the cause of the duplication, that the prescription had been previously compounded and tested by the prescriber himself.

FIG. 395.



Prescription with ambiguous signa.

FIG. 396.

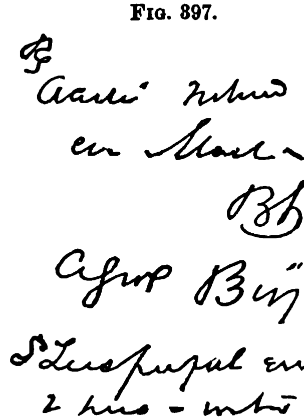


Involved prescription.

Prescription 395 would probably offer some difficulty in compounding on account of the deficiency of water, particularly in cold weather, potassium bromide being much more soluble in warm than in cold water. But the chief interest in this prescription centres in the directions to the patient, who, if so unfortunate as to be "unable to sleep in water," is required to take a "full" teaspoonful.

In prescription 396, which was written by a German physician of the old school, we have an illustration of a peculiarly involved and cramped style; the difficulty in deciphering the original being greatly enhanced by the doctor's selection of a narrow, soiled piece of paper and a soft black lead-pencil as the means of communicating his ideas of the patient's needs. The fac-simile gives the style and the construction of the letters correctly, but fails to reproduce the imperfections of the lead-pencil and coarse paper. Three and a half drachms of cascarilla bark, two drachms of asarum root, two grains of ipecac root, six drachms of bruised juniper berries, are to be infused with sufficient hot water to make the strained infusion measure six ounces, in which are to be dissolved fifteen grains of extract of lactucarium; it is then mixed with six drachms of camphor water, one and a half drachms of cherry laurel water, twelve drops of simple tincture of opium, and ten drachms of syrup of orange peel. A tablespoonful every three hours.

FIG. 397.



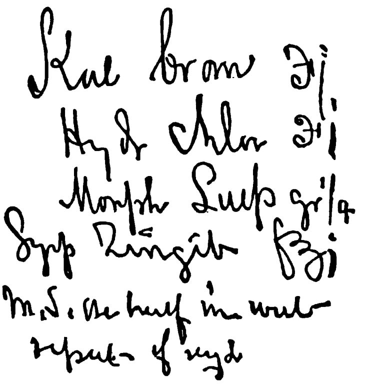
Badly-written prescription.

The prescription shown in Fig. 897 is a type of a style familiar to all who have occasion to read prescriptions. No attention whatever has been paid to reserving a line for each ingredient, and faulty abbreviation and careless writing have made a

prescription not easy to decipher with any degree of certainty. If physicians would endeavor to use the officinal names for the preparations they prescribe, much labor would be saved and the liability to err would be greatly lessened. Half a fluidrachm of nitric and muriatic acid with three and a half fluidounces of water is the translation, and it is known in this case that the official nitro-hydrochloric acid was wanted.

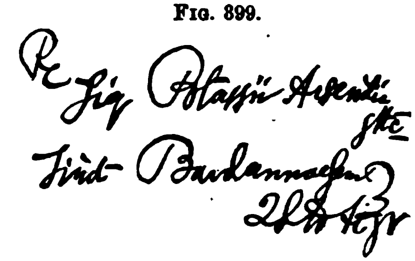
Fig. 398 affords another illustration of want of care in writing a prescription. Some of the letters show an ability on the part of the writer to form letters properly, which would indicate that he could write a legible prescription if he wished to; but the illegibility increases as the end of the prescription is approached, and hurry is plainly indicated. It happened that the medicine was intended for a poor dispensary patient; but one might suppose that

FIG. 398.



Carelessly-written prescription.

FIG. 399.

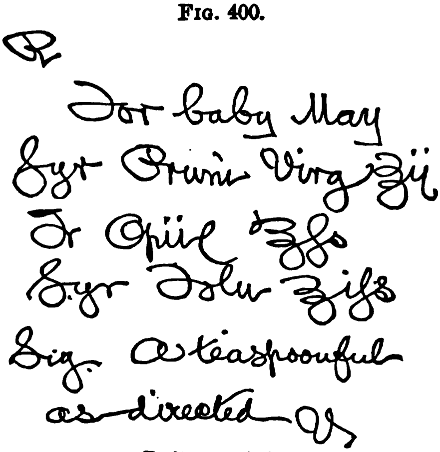


Odd prescription.

poverty and sickness are heavy enough burdens to carry without having the additional and unnecessary one of the risk of losing life. One scruple of potassium bromide, one scruple of chloral hydrate (not chloride of mercury, calomel, or corrosive sublimate), one-quarter of a grain of morphine sulphate, are dissolved in one fluidounce of syrup of ginger. One-half is taken in water. *Repeated if required.*

There is no lack of legibility in prescription 399; it is presented as showing a custom which some physicians practise,—*i.e.*, the employment of an unusual name. The object of using an out-of-the-way name may be a laudable one, although the physician usually is given the credit of trying to cover up some secret arrangement with an initiated and favored pharmacist. In this case the word "bardane" appears in the Dispensatory, and no intelligent pharmacist would have any difficulty in understanding that tincture of burdock seed was wanted. This being unofficial, it would be desirable to know from the physician what strength of tincture might be preferred.

FIG. 400.

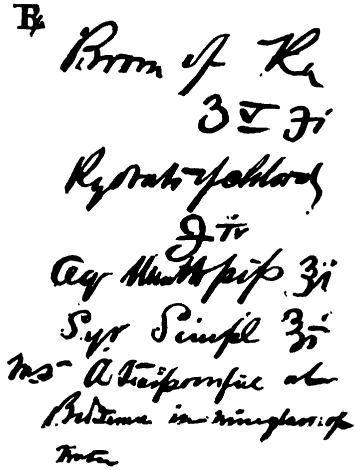


Faulty prescription.

At first glance it would seem that prescription 400 is ordinarily well written and free from fault. When the cautious dispenser looks it over carefully, however, he will observe that half a fluidounce of tincture of opium in a four-ounce mixture, with a teaspoonful dose, would be a large quantity for "Baby May," and in all probability would permanently end her pain. A thorough examination indicates an abortive attempt at forming the letter "c" after the "opii," and if the ingredient is rendered "camphorated tincture of opium," a popular cough-mixture is revealed, which is really what was intended by the prescriber.

Fig. 401 illustrates the effects of the loose methods that dispensary physicians are apt to acquire through the great haste usually practised in "getting through a clinic on time." Abbreviations, mixed Latin and English, and general lack of finish characterize this style. Five drachms and one scruple of potassium bromide and four scruples of chloral hydrate are to be dissolved in one fluidounce each of peppermint water and syrup; the quantity of bromide is excessive, and if the peppermint water is of full strength, a cloudy mixture results, due to throwing the volatile oil dissolved in the peppermint water out of solution. "A teaspoonful at bedtime in wineglass of water" should surely give the needed rest to the patient.

Fig. 401.



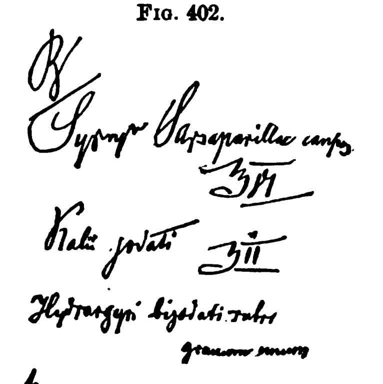
Odd prescription.

The prescription shown in Fig. 402 was written by a well-educated German physician, and is presented as showing unusual care in designating the quantity of the dangerous ingredient. It certainly is rare to see upon American prescription-files the quantity of any ingredient spelled out in full, either in Latin or in English; indeed, the whole prescription gives evidence of careful thought. One grain of red mercuric iodide and two drachms of potassium iodide are to be dissolved in six ounces of compound syrup of sarsaparilla.

Fig. 403 shows a style now fortunately extinct in Philadelphia,—the worthy author having been "gathered to his fathers." He was a physician of excellent character, large practice, and unusual sagacity, but, alas! of execrable memory in prescription-writing. Several of his prescriptions will be shown in this series, but the one now under consideration exhibits "one of his best." Two drachms of Goulard's extract, three grains of morphine sulphate, and two ounces of prepared lard (not lord) are to be rubbed together.

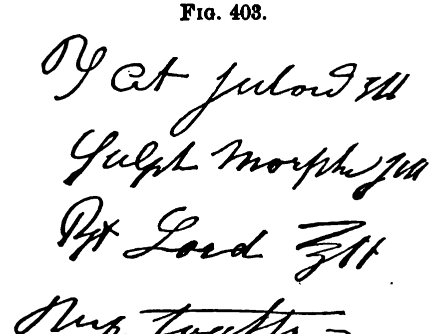
Fig 404 is presented mainly with the view of illustrating a German custom which has not been adopted in this country to any extent by American physicians; such

Fig. 402.



Careful prescription.

Fig. 403.



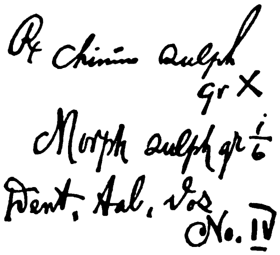
Badly-written prescription.

prescriptions are common, however, in large cities. It will be noticed that the quantities are those for one dose. The abbreviated subscription is in full, "Dentur tales doses No. IV,"—let four such doses be given. The absence of any further direction to the apothecary might raise the question, Are powders or pills intended? But as

the ingredients themselves are in the form of crystalline powders, and as pills are not specified, it would be proper to dispense four powders.

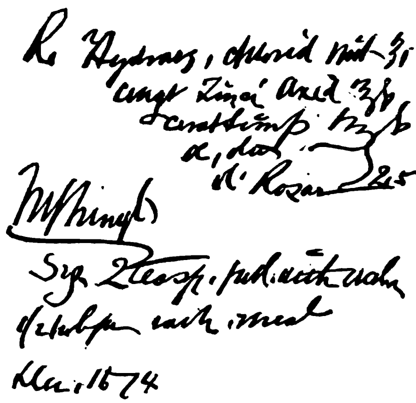
Prescription 405 is a fac-simile of one penned by a noted Philadelphia physician. Although not written in the clearest style, still it is legible, and no one would hesitate about preparing the ointment by taking one drachm of calomel, half an ounce of ointment of zinc oxide, half an ounce of simple cerate, and sufficient olive oil and oil of rose to make a smooth and sweet-smelling ointment; but just here the apothecary will halt,—for, notwithstanding the attractiveness of the "unguent" and the delicious savor exhaled by it, it would not be judicious to label the box as the doctor has directed: "Two teaspoonfuls with water half an hour before each meal." It is clearly a case of "lapsus calami," and no harm would ensue if the apothecary were to shelter himself behind that convenient barrier provided for all such cases, and simply write on the label, "Use as directed,"—for it is hardly likely that the doctor made the same error when giving the patient verbal directions that he has done in writing the prescription. In handing the ointment to the patient, any undignified tendency that the dispenser may have to relieve his feelings must be rigidly suppressed.

FIG. 404.



German prescription.

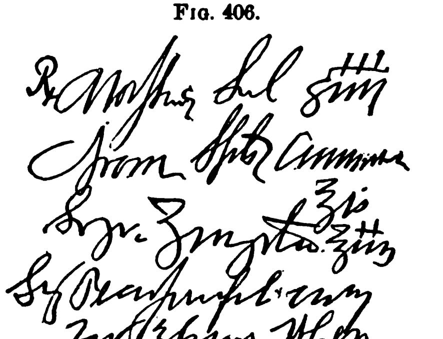
FIG. 405.



Erroneous signa.

Prescription 406 exhibits ignorance of the laws of chemical incompatibility, coupled with a careless style of writing; yet abundant evidence of ability to write better is furnished in the formation of many of the letters. Three grains of morphine sulphate are to be dissolved in half an ounce of aromatic spirit of ammonia and two and a half ounces of syrup of ginger. The directions are, "a teaspoonful every two or three hours when pain is severe." The incompatibility belongs to the class illustrated in Chapter LXV., and is due to the fact that alkalies precipitate alkaloids from alkaloidal salts. The danger here would be apt to arise from the alkaloid morphine precipitating out and collecting in the bottom of the bottle, and the liability of the patient swallowing a poisonous quantity if the last dose be taken.

FIG. 406.

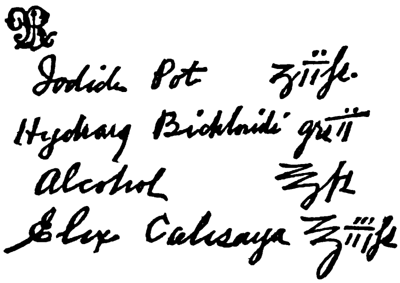


Badly-written prescription.

Fig. 407 shows a mixed style. The writing is legible, but "Iodide Pot," an abbreviation of the English name, and "Hydrarg Bichloridi," a partial abbreviation of the Latin name, with the lack of knowledge of correct terminology or abbreviation shown in writing out the other ingredients, quite prepare one for the writer

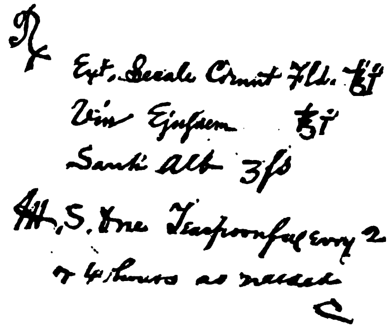
ignoring the fact that the potassio-mercuric iodide formed by dissolving corrosive sublimate in solution of potassium iodide will be apt to precipitate the cinchona alkaloids in the elixir of calisaya (see page 1081), for it is now the most useful and the most delicate reagent for alkaloids that has ever been discovered. One thing may, however, prevent this danger,—*i.e.*, the use of one of the very agreeable but worthless elixirs of calisaya that contains no alkaloids.

FIG. 407.


℞
Iodide Pot ℥iiss.
Hydrarg Bichloride gr. ii
Alcohol ℥ss
Elix Calisaya ℥iiiss

Incompatible prescription.

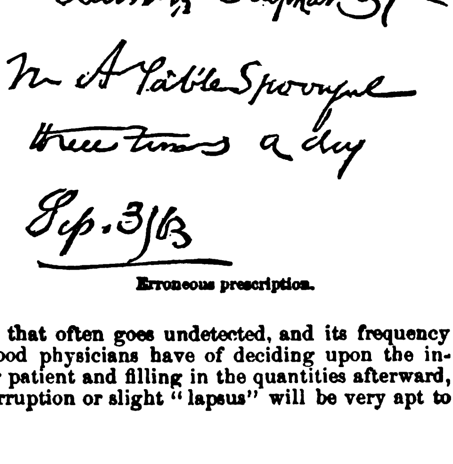
FIG. 408.


℞ Ext. Secale Cornut Fld. ℥i
Vin Ejusdem ℥i
Sacch Alb ʒss
M. S. One Teaspoonful every 2 or 4 hours as needed

Prescription.

In the case of prescription 408 no serious fault can be found with the manner of writing it; the interest in it simply lies in the fact that the druggist to whom it was presented had forgotten his Latin, the school-master being needed. The second article proved a poser to him, and, after searching through the dispensatories and text-books, and finding no substance in the materia medica bearing the title of "Ejusdem," he concluded that it was one of those "new-fangled proprietaries" that doctors are always writing for, and, with an air of injured dignity and superiority, he informed the patient that one of the ingredients he did not keep, and, returning the prescription, sent him away. The patient succeeded easily in having the prescription compounded by a neighboring pharmacist, and the story leaked out. The translation is, one fluidounce of fluid extract of ergot, one fluidounce of wine of the same (ergot), and half a drachm of white sugar.

FIG. 409.

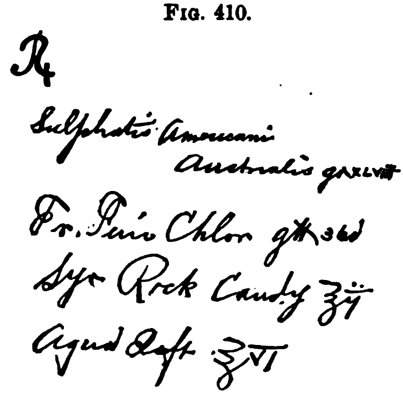

℞ Syr Acaciae ℥iii
Tr Card Comp gr xvi
Quiniae Sulphat ℥i
M. A Tablespoonful three times a day

Erroneous prescription.

Prescription 409 is a fac-simile of one written by a well-known physician. It is legible, and free from serious fault, with one exception,—the quantities have been inadvertently transposed. Sixteen grains of compound tincture of cardamom and one ounce of quinine sulphate are so far away from reasonable expectations that there should be no difficulty in "diagnosing this case" and deciding it to be one of transposition of quantities. It would be fortunate indeed if all instances of transposition were as glaring as this. It is a fault that often goes undetected, and its frequency arises from the habit which many good physicians have of deciding upon the ingredients that they wish to give their patient and filling in the quantities afterward, not in consecutive order. An interruption or slight "lapsus" will be very apt to cause transposition.

In prescription 410 an illustration is given of the use of a specially-coined term to designate a well-known substance, the intention being to calm the fears of a patient who has a perhaps unreasonable prejudice against a remedy which the physician believes to be necessary to alleviate the malady. Circumstances arise in the practice of every physician when patients need a remedy which they will refuse to take if they are aware of it, and hence the alleged necessity for the use of an unusual term which they will not understand when written on the prescription. "Sulphatis Americani Australis," South American Sulphate, is, in plain English, sulphate of quinine. The stilted Latin by which the first ingredient is designated is in strong contrast with the plain English of the third ingredient,—"Syrup of Rock Candy." The last line may cause a little studying, but it is soon translated Aqua q. s. ft. ℥vi.

FIG. 410.

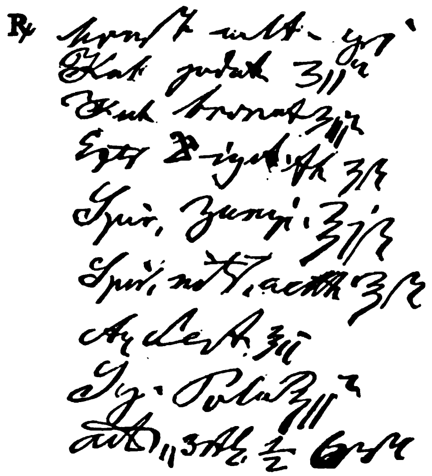


Puzzling prescription.

Fig. 411 is a fac-simile of a prescription written by a German physician, which at first appears curiously involved, but really presents no great difficulty in deciphering when carefully scanned. One grain of morphine sulphate, two drachms of potassium iodide, three drachms of potassium bromide, half a drachm of ethereal extract of digitalis, one and a half ounces of spirit of juniper, half an ounce of spirit of nitrous ether, two ounces of distilled water, and two ounces of syrup of tolu, are the ingredients; whilst the signa, or the directions to the patient, are,—every three hours half a tablespoonful.

Prescriptions like the fac-simile shown in Fig. 412 should be declined when presented, potassium permanganate exploding violently when mixed with glycerin and other bodies containing organic matter. This fact, and the additional one that glycerin does not have two i's, were doubtless overlooked by the writer of the prescription.

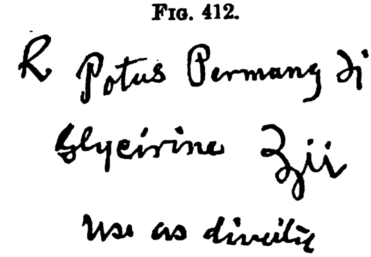
FIG. 411.



German prescription.

Prescription 413 has defied the efforts of all experts in calligraphy up to the present time. The author has shown the original and the fac simile to more than one hundred skilled pharmacists without receiving a correct solution from one of them. It was written by a Cleveland physician in the ordinary course of business, and was presented to the author by a brother pharmacist. The principal difficulty in deciphering it arises from the fact that two ingredients are unofficial and rather out of the way, and, in addition, their titles are run together and obscured almost beyond recognition. The full translation is as follows: "Dec. 14, 88. 97739. Quinia Sulph. ℨi; Elix. et Syr. Glycyrrhiza Co. āā ℥ij. M.—Tablespoonful 3 times a day." The author

FIG. 412.



Explosive prescription.

was informed by a pharmacist who was familiar with the doctor's method of writing prescriptions that the above specimen was not unusually obscure.

Fig. 414 is a fac-simile of a prescription for an eye-wash. The original was written with a hard lead-pencil upon a rough bit of paper. Any one familiar with the doctor's style would have little difficulty in solving the obscurity by dissolving four grains of zinc sulphate and ten grains of sodium borate in two ounces of rose-water. Incidentally, it may be remarked that precipitation frequently occurs in prescriptions of this character, due to precipitation of hydrated zinc oxide by the alkali in the sodium borate. It is better to filter the mixture than to add a little

FIG. 413.

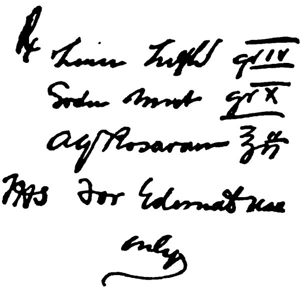
Flourishing prescription.

sulphuric acid to clear the solution, because the slightest excess of the latter might prove irritating.

The habit of making one letter look exactly like some other letter is one of the worst faults that a writer can have, and it is usually only a question of time for a prescriber with such a habit to make a serious error. It will be observed that in the fac-simile (Fig. 415) the fault is that the doctor's small "a's" are always "o's." He writes "Tonnici" for "Tannici." "Inoke" is intended for "make." The next word is not "mte," but "into." The words "six suppositories" are, fortunately, plain enough, and the directions, "One night and morning," present no difficulty to a good guesser. The writer is an intelligent and unusually able physician, and force

and character are indicated by the general style of the writing, marred, however, by the one serious fault.

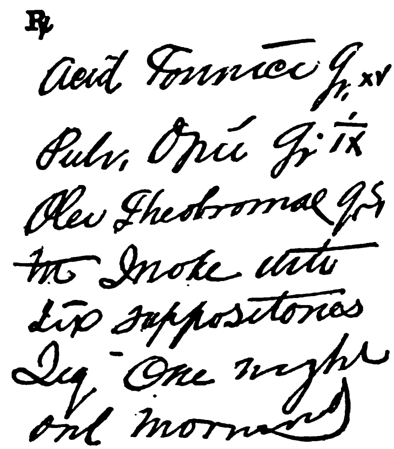
FIG. 414.



Obscure prescription.

A study of the prescription illustrated in Fig. 416 will thoroughly justify the verdict that no extenuation can be fairly accorded to the writer. The fac-simile cannot show the crumpled piece of manilla-paper, nor reproduce the indistinct lead-pencil marks, which are prominent characteristics of the original,—yet it was written by a noted physician "in a hurry." Who would guess that the first line is "Tinct. Iron"? and if any one should be so fortunate as to get so far, could he by any possibility translate the remainder?—"Take a teaspoonful mixed with (8) tablespoonsful of warm water sweetened, an hour before eating and at bedtime;" and yet this is the translation which was given by the friend who sent it to enrich the author's collection and affirmed to be correct. The difficulty about the acceptance of this guess centres around the word which is rendered "sweetened." The other words may or may not be correctly deciphered. Doubt and confusion reign supreme.

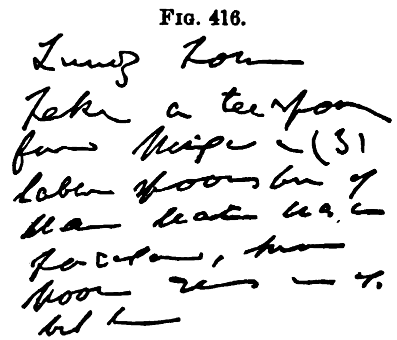
FIG. 415.



Faulty prescription.

The use of chemical symbols in writing prescriptions is not a common custom, and although there can be no serious fault found with the prescription shown in fac-simile in Fig. 417, there are objections to the custom notwithstanding some advantages. To begin with the latter, symbols are usually brief, distinctive, and capable of being written in unmistakable characters, but a physician who attempts to use them altogether must have a circumscribed list of remedies to prescribe from, for symbols have not been contrived for elixirs, syrups, or any galenical preparation; then, again, the symbols for alkaloids and some of the new antipyretics would be complicated and not so easily nor so clearly made out as the usual Latin abbreviations. In the example shown it is plain that the prescriber wants four drachms of sodium bromide and half a drachm of potassium iodide dissolved in two ounces of water.

FIG. 416.

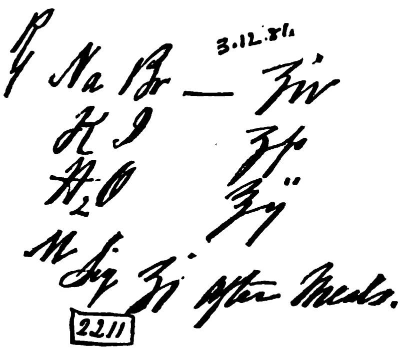


Badly-written prescription.

Fig. 418 is a type of prescription which is very frequently seen in practice. It is impossible to expect any physician to retain in his memory the solubilities or exact physical properties of all the substances that he desires to prescribe. As pharmacy has advanced prescribers have grown into the habit of depending upon pharmacists to use their art in supplying the needed knowledge; and it follows, as a matter of course, that those who make a profession of handling the substances that enter into prescriptions every day should have this information at their "finger-tips." In this prescription two minims of oil of copaiba, two grains of magnesia, and one grain of powdered acacia are the ingredients for one pill, and the directions are that "thirty-six such pills are to be sent." A little more magnesia, a trace of water, and possibly a little powdered soap are needed to give the mass sufficient adhesiveness and firmness.

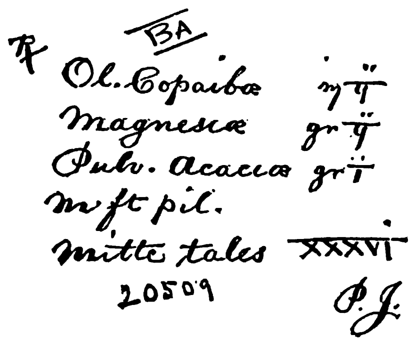
A prescription like the one shown in Fig. 419 bears evidence of error on its face. The subscription directs a mixture to be made, and seventy-five per cent. of the mixture is composed of solids. On the other hand, the dispenser is unable to guess whether the prescriber made an error in directing a mixture, or whether, unable to class the compound as an ointment, he has concluded to call it a mixture, and that the quantities of the ingredients are just what he intended to write. Probably most pharmacists would mix the powders thoroughly, rub in the petrolatum and lime-water, and dispense the mixture in a box, labelling it, in the absence of directions, "Use as directed." If the physician could not be seen, this would be the course

FIG. 417.



Prescription in symbols.

FIG. 418.

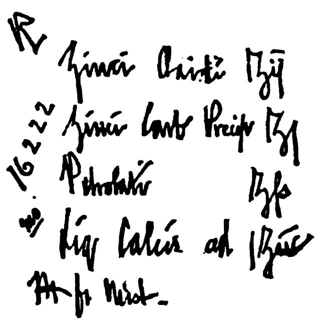


Pill prescription.

to pursue; but in the above case the quantity "f℥iv" after the "Liq. Calcis ad" happens to be a mistake: it should have been "f℥iv," and it was intended for an external application to an inflamed surface. There are, however, many instances on record where similar errors which were never corrected have occurred and the prescription dispensed as written, the patient subsequently returning to have the apparently absurd prescription renewed and ultimately praising the doctor for the speedy cure which had been effected.

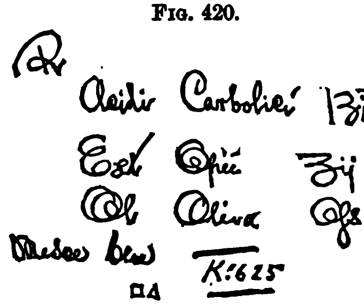
In prescription 420 physical incompatibility is illustrated. Extract of opium is an

FIG. 419.



Erroneous prescription.

FIG. 420.

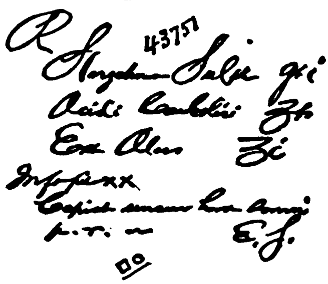


Incompatible prescription.

aqueous extract, the greater bulk of it being insoluble in olive oil. The mixture is evidently intended for an external application, and all that is expected is a reasonably smooth mixture. The proper method of compounding this would be to rub the extract of opium with sufficient water to make a smooth paste. Now, having poured the oil into the bottle in which the mixture is to be dispensed, add the carbolic acid, shaking it well until solution is effected, then gradually add the thick aqueous mixture of extract of opium, shaking after each addition. Do not filter the mixture, but dispense with a shake-label.

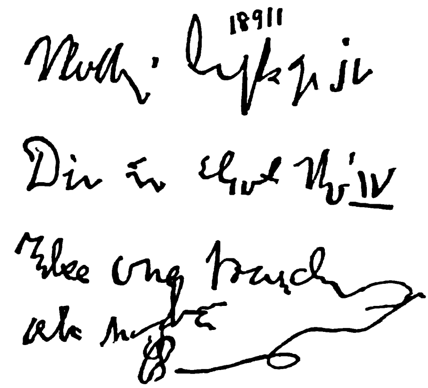
Prescriptions like the one shown in Fig. 421 are very common: too much liquid has been ordered. It is a difficult matter for prescribers to educate themselves in the matter of not exceeding practical limits in ordering liquids for pill masses; indeed, the absorptive power of the solid substances used in making pill masses varies so much that usually nothing short of an actual attempt to make the mass will prove the extent of the excess. In this case in all probability the prescriber regarded carbolic acid as a solid, and he did not know of its tendency to liquefy under warmth and manipulation and its liability to cause other solids to soften. The difficulty here is that if sufficient absorbent powder be used to take up the excess (powdered althea would

FIG. 421.



Faulty prescription.

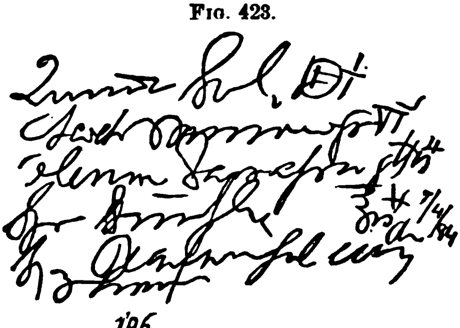
FIG. 422.



Intemperate prescription.

be an excellent one to use here) the pills will be very large. A nice question arises just at this point: Has the pharmacist the right to double the number of pills and alter the doctor's directions so that the dose shall be two pills instead of one? There are certain occasions when this may be done, *but they should be rare indeed.* It is not creditable for a pharmacist to acquire a reputation for altering the directions of a physician. Every expedient known to the art should be exhausted before attempting the slightest change, and, if it must be, the intention of the prescriber should always be kept closely in view. In the above case if the number of pills is doubled without the doctor's sanction or knowledge the patient must be acquainted with the fact at the time, otherwise he will suspect that the pharmacist has blundered and has made too many pills; and if the patient is informed about it when the pills are dispensed, unless great tact is used he will probably suspect that the doctor does not understand his business, and may state his opinion to him at his next visit, in which event the pharmacist will probably have a call from the doctor. The best practice is to notify the prescriber at once of the change and let him make the necessary explanation to the patient.

FIG. 423.



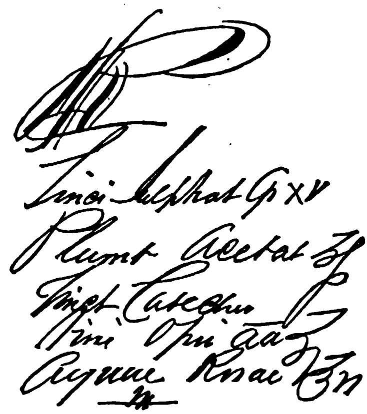
Carelessly-written prescription.

Prescriptions like the one shown in fac-simile 422 are fortunately rare. It was written and presented personally by a physician very early in the morning, soon after having parted with some friends with whom he had been spending the evening, the pharmacist having been rung up by the night-bell to dispense it. The prescriber's mental condition is accurately indicated by the fluctuating irresolution of some of the written characters and by the poisonous dose of morphine. He endeavored to explain that the dose was intended for himself, and it is hardly necessary to say that it was not dispensed as written. The translation is—Four grains of morphine sul-

phate divided into four powders; take one powder at night. He really wanted one grain divided into four powders, and this was given to him. In cases of this kind a pharmacist could not be justly condemned for refusing to compound the prescription; and, indeed, it should be the rule always to decline to furnish morphine or other poisonous remedies to any intoxicated person. In this particular instance the physician had friends with him who made themselves responsible for his safety.

Prescription 423 is another illustration of a badly-written prescription, and one which defies the laws of both chemical and physical incompatibility. One scruple of quinine sulphate, six grains of morphine acetate, two drops of oil of sassafras, and five and a half ounces of simple syrup are to be mixed, and a teaspoonful administered every three hours. The insertion of the curious character, which resembles a capital letter A reversed, is an illustration of a careless and reprehensible method of correcting an error. The quantity originally attached to the "Syr. Simple" was ℥ss; this would yield a poisonous quantity of morphine, the mixture being given in teaspoonful doses. The addition of v over the "ss" was intended to make the dose of morphine a proper one; but it would in most cases fail signally to accomplish the intention of the prescriber, for it would not be so interpreted. When strong solutions of quinine sulphate and morphine acetate are brought together, decomposition results, with the production of the insoluble acetate of quinine (see page 1067); in addition to this, the oil of sassafras would not dissolve entirely in the syrup, and it would consume a great deal of time to filter so thick a mixture. The only way out of such a combination of errors for the pharmacist, in the absence of the physician, is to paste a shake-label on the bottle and dispense it.

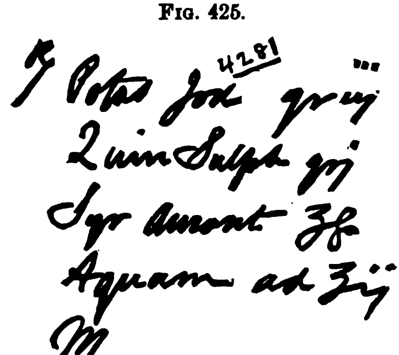
FIG. 424.



Carelessly-written prescription.

In prescription 424, which is reasonably well written, is afforded an example of intentional incompatibility. Fifteen grains of zinc sulphate, half a drachm of lead acetate, and one drachm each of tincture of catechu and wine of opium are to be mixed with six ounces of rose water. This mixture should not be filtered, of course. The unusually elaborate character for recipe at the top of the prescription might reasonably be accused of indicating a relapse to the habit of former ages, when prescriptions were decorated with mystic signs. These were supposed to possess supernatural powers. The patient who needed such a prescription as 424, however, probably required a special invocation.

FIG. 425.



Incompatible prescription.

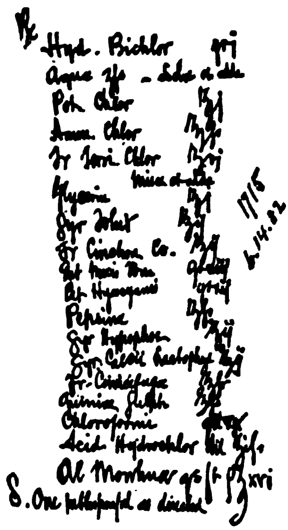
In 425, precipitation, due to decomposition between the potassium iodide and the quinine sulphate, will take place here and quinine iodide will separate. The addition of mucilage as a retarding agent has been recommended in such cases, but it is very ineffective, and the best course is to depend upon a shake-label pasted on the bottle, with verbal directions to the patient to call attention to the necessity for shaking the mixture before taking a dose. Iodides and bromides should never be given in combination with alkaloidal salts. (See page 1176.)

There can be no difficulty in reading this prescription. The translation is—Three grains of potassium iodide, one grain of quinine sulphate, half a drachm of syrup of orange, with sufficient water to make two drachms.

Fig. 426 is a copy of a prescription which was written by a physician in Canada.

Three similar prescriptions were sent to the author by a Canadian pharmacist to enrich his collection, and the one selected for this illustration is by no means the best or the worst. They were all written by the same physician. He believes in "polypharmacy" and the doctrine that "there can't help but be something in such a prescription which will do good." Such prescriptions are not worthy of analysis. The best way to compound this one is to mix all the solids, reduce them to as fine a powder as possible, dissolve them in the mixed liquids, leaving out the chloroform and cod-liver oil; then with the aid of acacia make a mixture with the cod-liver oil and chloroform. No attempt to prepare a clear solution of the solids need be made; any excess will be suspended in the emulsion of cod-liver oil.

FIG. 426.

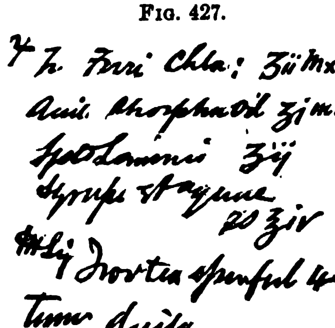


Polypharmacal prescription.

Fig. 427 is a fac-simile of a prescription which has been carefully considered by the prescriber; he has evidently bestowed the greatest attention upon the dose of the active ingredients, but there is considerable obscurity about the third ingredient. An experienced compounder, however, would read the prescription without difficulty. Two drachms and forty minims of tincture of ferric chloride, one drachm and forty minims of diluted phosphoric acid, two drachms of spirit of lemon, and syrup and water to four ounces. "Two teaspoonful" four times daily. A precipitation may take place when the tincture of ferric chloride is mixed with the diluted phosphoric acid, due to the formation of insoluble ferric pyrophosphate, particularly if the diluted phosphoric acid which is used has been freshly made. This precipitate may be dissolved by adding a trace of potassium citrate or any alkaline citrate.

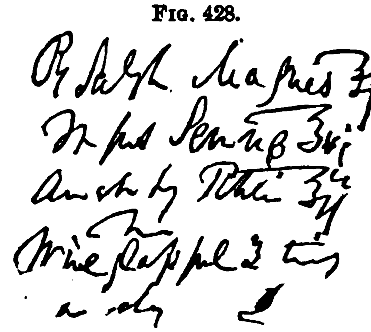
The fac-simile shown in Fig. 428 is that of an old-fashioned prescription, and a type of the sort now fortunately numbered with the past. Epsom salt, infusion of senna, and aromatic syrup of rhubarb form a trio which would be difficult to surpass in developing nausea; but the dose,—a "wineglassful three times a day" (presumably about meal-times),—if retained, would be likely to prove an efficient cathartic. The second line might be translated, compound infusion of senna, but the letters which look something like "co" are evidently "æ," and the use of simple infusion of senna was common at the time when this prescriber studied

FIG. 427.



Obscure prescription.

FIG. 428.



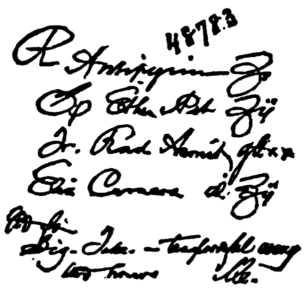
Carelessly-written prescription.

medicine. The third line is somewhat obscure also, but the intention of the prescriber is so apparent and its artlessness is so sincere that the line may be easily guessed. One ounce of magnesium sulphate, six ounces of infusion of senna, and two ounces of aromatic syrup of rhubarb are to be compounded.

Fig. 429 is a prescription which offers a strong contrast to the preceding one.

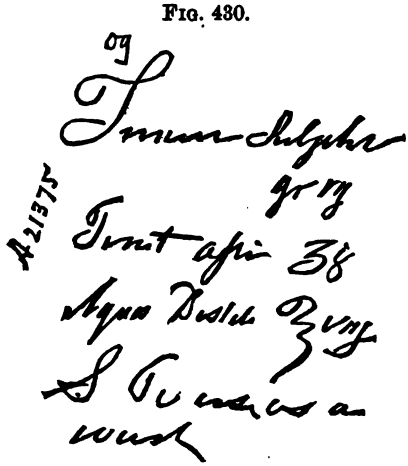
It represents modern therapeutics in more senses than one: the use of a patented and copyrighted medicine (a growing evil), and the comparatively new method of treating pyrexia by using an agent which distinctly lowers the temperature. An emerald-green coloration is apt to be produced when antipyrin is brought in contact with nitrous compounds. This cannot be avoided. Investigation seems to indicate, however, that no dangerous poison is developed through this decomposition; yet it would be better to avoid prescribing antipyrin with spirit of nitrous ether until the action is clearly determined. The substitution of antifebrin or any other antipyretic for the one ordered, without the physician's knowledge or consent, as sometimes practised, is entirely without justification.

FIG. 429.



Modern prescription.

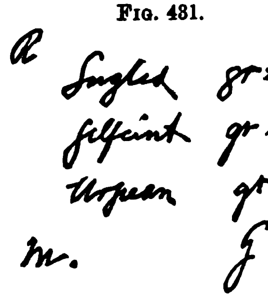
FIG. 430.



Badly-written prescription.

Prescription 430 shows illiteracy and general deficiency. Seven grains of zinc sulphate, one drachm of tincture of opium, and eight ounces of water are to be made into a lotion, and the direction is "To use as a wash." The letter "Z" is very far from being the ordinary form, and much more resembles the letter "T," whilst the other letters of this word are not recognizable as "inci;" "opi," in the second line, is more like "api," and, since preparations of celery and parsley, both "apiums," are now prescribed, there might be some danger of confusion if the construction of the letters were alone depended upon. The evident *intention of the prescriber* is a very important element, however, in guiding the pharmacist, who is expected to unravel the mysteries of compounding prescriptions.

FIG. 431.



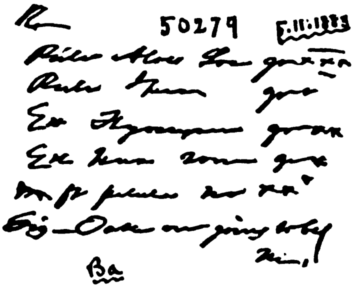
Misleading prescription.

Prescription 431 must not be read with the Pharmacopœia as a guide; but it is best to have a layman read the prescription hastily, and then judge by the sound how near such sounds resemble those of the names of familiar substances and which might be used in pronouncing "sugar of lead," "sulphate of zinc," "morphine." The object of writing such a prescription is concealment; and it is far safer for the pharmacist to decline to become a party to a questionable procedure, particularly one which involves the sale of a poisonous dose of morphine unauthorized by a physician. The intention is to add water to the mixture and thus complete the lotion. The temptation to overcome difficulties or to increase the number on the prescription-file and to meet all possible contingencies should not be allowed to warp the pharmacist's judgment. Improper prescriptions should be declined politely but unconditionally.

Prescription 432 has been hastily written, but it is reasonably clear. The quantity attached to the first ingredient is somewhat ambiguous. Should gr. xxx or gr. xxv be dispensed? The upper part of the last x has been imperfectly made, so that an inverted v is the result. It is impossible that such a character as an inverted v would be used intentionally. Hence the conclusion is reached that thirty

grains are wanted. This, with five grains of powdered ipecac, twenty grains of extract of hyoscyamus, and ten grains of extract of nux vomica, is to be made into twenty pills. The signa must also be read in the light of "obvious intention." The reading is clearly, "Take *on* going to bed." But the taking of twenty pills must be instantly dismissed from consideration, and the successful guess is then made that the "e" of the one has been flourished out of existence, and that the intended reading is, "Take *one* going to bed."

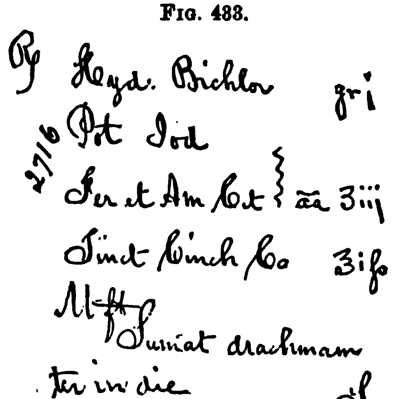
FIG. 482.



Carelessly-written prescription.

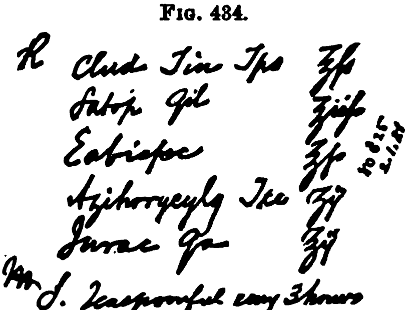
Prescription 483 has been contrived with a disregard of the laws of chemical and physical incompatibility. Precipitation takes place, and this is due to the formation of potassio-mercuric iodide, the alkaloidal reagent (see page 1081), and its reaction with the alkaloids in the compound tincture of cinchona. In addition to this, the quantity of ferric citrate is excessive: the prescriber may have intended to add sufficient water to effect a solution and then have forgotten to do so. The only course left for the pharmacist, if unable to communicate with the prescriber, is to dissolve the mercuric chloride in the compound tincture of cinchona with the aid of sufficient potassium iodide. This disposes of the dangerous ingredient. Then having reduced to powder the remaining solids, they are to be added and the prescription dispensed with a shake-label, without filtering. There would be no impropriety in directing the patient to take the teaspoonful of medicine with water, and in this way the excess of soluble salts could be dissolved; but by far the best procedure would be to have the prescriber alter the prescription. One grain of mercuric chloride and three drachms each of potassium iodide and ammoniated ferric citrate are to be dissolved in one and a half ounces of compound tincture of cinchona. Let a drachm be taken three times daily.

FIG. 483.



Incompatible prescription.

FIG. 484.



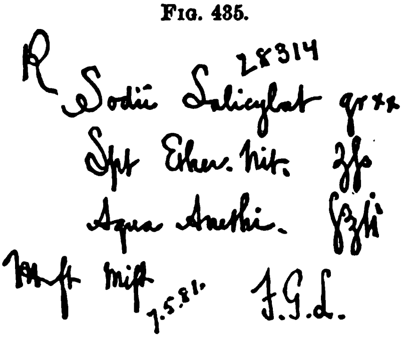
Travestied prescription.

Prescription 484 is an illustration of a travestied prescription, the intention being to mask its meaning so that only the initiated may be able to unravel its mystery. The method selected here is very simple, consisting in writing the names of the ingredients backward, and with this key the reading is very simple,—half an ounce of sweet spirit of nitre, two and a half ounces of solution of potassa, half an ounce of copaiba, two drachms of extract of liquorice, and two ounces of caraway water are to be made into a mixture.

Prescriptions like the one shown in Fig. 485 are common, and they cause a great deal of trouble,—twenty grains of sodium salicylate, half a drachm of spirit of nitrous ether, and two fluidounces of dill water. Owing to some decomposition between the nitrous compounds of the spirit of nitrous ether and the salicylic acid in the sodium salicylate, the nature of which is complicated and has never been determined, a

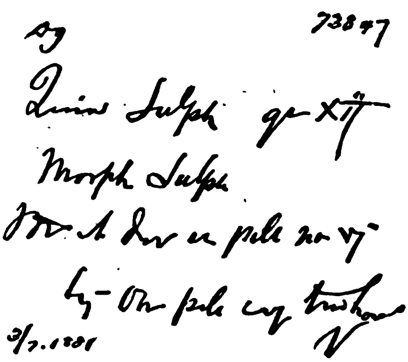
darkening in color which eventually results in the formation of a blackish deposit takes place and the odor of oil of wintergreen is observed. The annoyance to the dispenser in a case of this kind is apt to be considerable; the patient noticing a change in the appearance of the medicine, and at once suspecting that some mistake has been made, takes it to the pharmacist, and no matter how complete the defence may be, nor how earnest the latter may be in his protestations that no mistake has been made, it is only with great difficulty that an unfavorable opinion of the pharmacist's ability can be averted. Previous knowledge on the part of the dispenser that such combinations produce such mixtures would lead to the return of the prescription to the physician, with the request that it may be modified so that the two offending substances may be given separately. If this cannot be done, the prescriber should be notified as soon after the delivery of the prescription as possible, so that the medicine for the patient may be changed at the next visit.

FIG. 435.


28314
R Sodii Salicylat gr xx
Spt Ether. Nit. ʒss
Aqua Anethi. ℥ii
M ft mist
7.5.81 J. G. L.

Incompatible prescription.

FIG. 436.

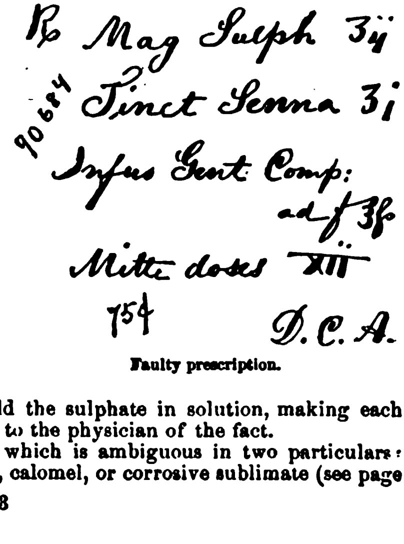

73847
Quin Sulph gr xii
Morph Sulph
M. ft div in pil no. xii
S. One pil ev. two hours
3/7.1881

Deficient prescription.

Fig. 436 shows a fac-simile prescription in which the quantity of one of the ingredients is omitted. It is presumed that the physician intended to write "gr. i" after "Morph. Sulph.," but it would not be proper for the pharmacist to insert the quantity upon his own judgment, except in case of an extreme emergency which would require prompt action without the advice of the prescriber.

No fault can be found with the legibility of prescription 437. The first line could only be translated "Magnesii Sulph.;" the termination to "Senna" is, however, incorrect, as it should have the genitive termination "æ" instead of "a." "Two drachms of sulphate of magnesia, one drachm of tincture of senna, and sufficient compound infusion of gentian to make half a fluidounce. Send twelve doses." Although the additional word "tales" is omitted in the directions, it is a fair inference that the prescriber wants the patient to take half a fluidounce for a dose; but the quantity of liquid is insufficient, and a portion of the sulphate will not dissolve. If the mixture is heated the excess will disappear, only to return on cooling in the form of a gelatinous precipitate. The usual course of notifying the physician should be followed if there is time, and if there is not, there would be no impropriety *in this case* of adding just sufficient water to hold the sulphate in solution, making each dose a little larger, and then sending word to the physician of the fact.

FIG. 437.

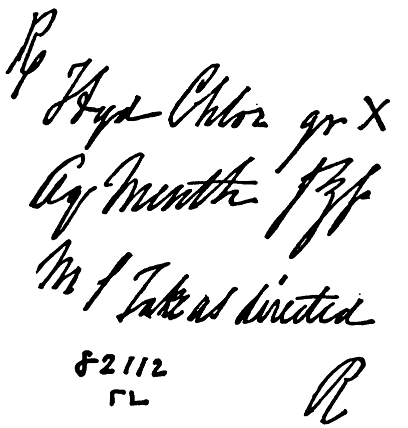

℞ Mag Sulph ʒii
90684
Tinct Senna ʒi
Infus Gent Comp:
ad f℥ss
Mitte doses XII
754 D. C. A.

Faulty prescription.

Prescription 438 is a fac-simile of one which is ambiguous in two particulars: "Hyd. Chlor." may mean chloral hydrate, calomel, or corrosive sublimate (see page

1118), and "Aq. Menth" may mean peppermint water or spearmint water. "Obvious intention" in this case is the deciding factor, and this apparently points to the conclusion that a soothing draught is intended of chloral hydrate and mint water. The directions, "Take as directed," should cause the pharmacist to pause. In this case, however, a dose of calomel was intended, with mint water as the vehicle. These facts were developed only by a few questions which were asked the patient, who happened to present the prescription personally and who without much provocation said that he was "that bilious" that the doctor had given him "the same medicine as before, for it did him so much good." Further inquiry developed the fact that this was "obvious intention" on the part of the prescriber, and it would have been a very poor conjecture to use chloral hydrate. The incident points clearly to the necessity for the possession of wisdom and caution almost supernatural if errors in judgment are always to be avoided. The use of spearmint or peppermint water when "Aq. Menth." is prescribed is largely a matter of local habit; in some sections mint water always means peppermint water; in other parts of the country spearmint water is preferred. Where local preference does not exist, the fact of the kind of mint not being specified would give the pharmacist an undoubted right to use either. In every case like this a marginal note should be made on the prescription, so that in case of renewal the same mint water may be used that was employed at first.

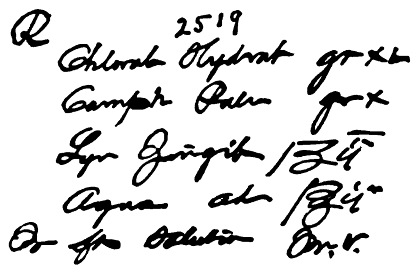
Fig. 438.



Ambiguous prescription.

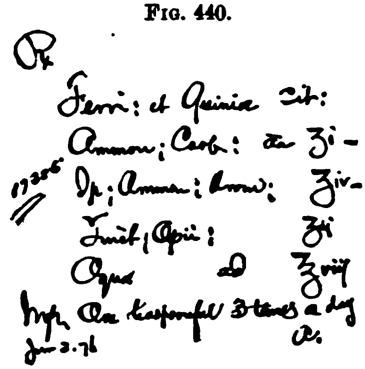
In prescription 439 there is an opportunity for the dispenser to utilize his knowledge and skill. Forty grains of chloral hydrate, ten grains of powdered camphor, and two fluidrachms of syrup of ginger are to be made into a solution, with sufficient water to make two fluidounces. Chloral hydrate and camphor, when rubbed together, form a liquid (see "Chloral Camphoratum," Part VI.). If advantage is taken by the dispenser of this knowledge, and if the two substances are rubbed in a mortar until a smooth mixture results, and if half a drachm of powdered acacia be added, with sufficient water to make a smooth mixture, and followed with the remainder of the water and syrup, it will be found that the camphor can be uniformly distributed in the mixture with no tendency to separate. The directions to "make a solution" are faulty, because a *solution* cannot be made with the ingredients named; but the pharmacist is justified in adding acacia to make a mixture, for otherwise the camphor will separate and cannot be combined uniformly.

Fig. 439.



Incomplete prescription.

Fig. 440.



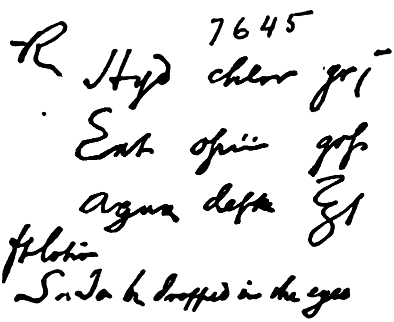
Incompatible prescription.

Prescription 440 exhibits chemical incompatibility. Iron and quinine citrate

should never be prescribed with alkaline salts; an excess of the latter will surely decompose the quinine salt, causing precipitation of the alkaloid. The prescriber evidently intends in this prescription to get the tonic effects of the quinine and iron, the sedative properties of the tincture of opium, and the correcting and stimulating influence of the compounds containing ammonia; but in attempting to get all of them bottled up in one mixture he has defeated his purpose,—the alkaloidal salt should either be made into pills or given in a separate preparation. One drachm each of citrate of iron and quinine and carbonate of ammonium is dissolved in water, aromatic spirit of ammonia, and tincture of opium, with sufficient water to make an eight-ounce mixture.

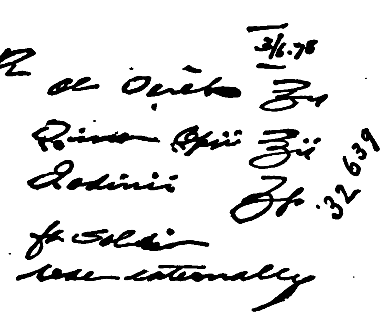
Prescription 441 is another illustration of incorrect abbreviation. "Obvious intention" cannot be used here to aid in the interpretation, because the intention is *not*

FIG. 441.



Faulty abbreviation.

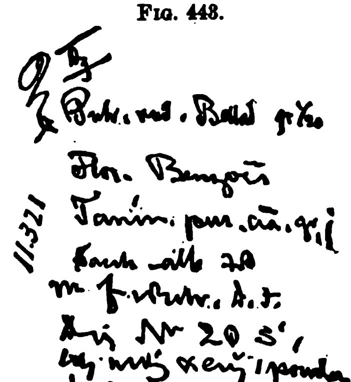
FIG. 442.



Incompatible prescription.

obvious by any means. A prescriber might want corrosive sublimate, calomel, or chloral hydrate. Most pharmacists would probably guess that corrosive sublimate was intended, particularly since its use in collyria is not uncommon. But the physician in this case wanted calomel, as he had conceived the idea of replacing the practice of blowing calomel into the eyes (which is sometimes resorted to) by the more refined method of making a lotion and dropping a portion of it into the eyes. One grain of calomel and half a grain of extract of opium are to be made into a lotion with one ounce of distilled water, care being taken to paste a shake-label upon the bottle. As a matter of practice it is very doubtful whether the heavy powder calomel could be distributed so uniformly through the lotion that one drop would contain the same proportion that another would.

FIG. 443.



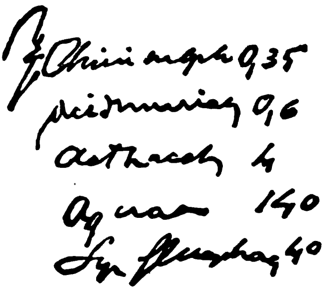
German prescription.

In prescription 442 the prescriber intends that a solution should be made,—for he has written "ft. solutio;" but he is no doubt ignorant of the fact that iodine is not soluble either in tincture of opium or in oil of turpentine. If the prescription is compounded as written, considerable irritation will be produced from the contact of the undissolved particles of iodine with the skin. If four drachms of the oil of turpentine be replaced by strong alcohol, and as much of the iodine dissolved in this as can be, and if the moist residue be then rubbed into a smooth paste and the oil of turpentine and tincture of opium added gradually and alternately, a mixture will result in which the undissolved iodine will be in a very fine state of division. The best course to pursue would be to get the physician to use extract of opium, iodine, potassium iodide, and water as a substitute, or a mixture of tincture of iodine and tincture of opium. Incidentally,

it may be mentioned that the legibility of a prescription is often seriously impaired by the careless habit of folding it before the ink is dry. This one has been blotted, though not very seriously.

Fig. 443 shows a fac-simile of a prescription written by a German physician. It is shown for the sake of practice for those unaccustomed to this kind. One-twentieth of a grain of powdered belladonna root, one grain each of benzoic acid and pure tannin, and sufficient white sugar. Make into a powder. Send twenty such powders. Every morning and evening one powder to be given.

FIG. 444.

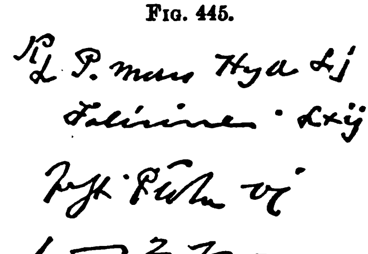


German prescription.

Fig. 444 is a fac-simile of another German prescription. This one is metric, and is to be compounded according to the German method, by *weighing the liquids* (see page 1156). It is badly written, the last ingredient being very indistinct. Thirty-five centigrammes of quinine sulphate, sixty centigrammes of hydrochloric acid, four grammes of acetic ether, one hundred and forty grammes of water, and forty grammes of syrup of orange flowers (fl. naphæ).

Prescription 445 shows peculiarities of composition that are strongly marked, the character selected for "gr." being unusually bad,—the habit of starting the "g" above the line and slurring the "r" making a character which resembles a capital script letter "L," or the one used to designate the British pound sterling, £. Whether to make six pills or six powders might cause the pharmacist a moment's hesitation, as the directions, "M. ft. pulv vi," are a little ambiguous. But the first line is an aid here. No prescriber would be likely to direct powdered mercurial mass if pills were intended, and it is therefore clear that six powders are wanted. The signa is not difficult for an experienced compounder to interpret: the flourish after "1" would be guessed to mean "every," and that after "2" to mean "hours."

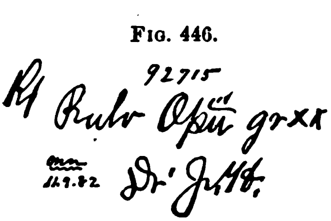
FIG. 445.



Badly-written prescription.

Fig. 446 is a dangerous prescription. The absence of any directions and the use of the abbreviation "Dr." before the initials would lead a cautious pharmacist to suspect that this is a forged prescription, written by an opium-eater for the purpose of obtaining his dose without difficulty or questioning. There are a few physicians who use their abbreviated title "Dr." before their initials, but it is not common except in certain localities, and an opium-eater wanting his dose would be very likely to put "Dr." before the initials, imagining that such an act would lull the suspicions of the pharmacist and thus his object be more readily accomplished; but a trick like this is very apt to overshoot the mark. Advantage may be taken of the fact that no directions have been given with the prescription, and if it is returned to the alleged patient with the request that the doctor write the directions upon it the difficulty can be easily met, or an offer may be made to send to the doctor for the information. If it is a forgery, the behavior of the patient will be apt to reveal it: he will probably take the prescription away and never return. On the other hand, if it is an honest prescription, both doctor and patient can but commend the caution and discretion of the pharmacist.

FIG. 446.



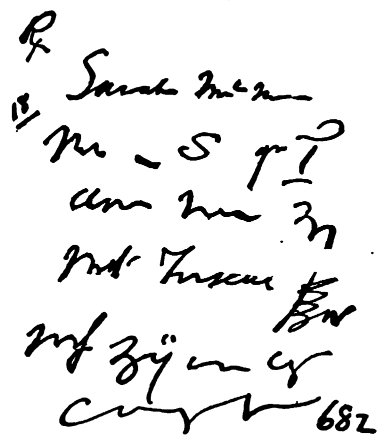
Forged prescription.

Prescription 447 is an illustration of one written by a dispensary physician "on the jump." To a pharmacist accustomed to such scrawls they present no terrors, but the uninitiated are often sadly mistaken in their interpretations. This prescription is not so illegible as some others of its class in the author's collection, but it has

been selected to show that dangerous poisons are sometimes prescribed in this very reckless fashion. Poor "Sarah McM." is expected to obtain relief for her "cough" by taking "two drachms" of a mixture made of one grain of morphine sulphate, one drachm of "muriate of ammonia," and four ounces of brown mixture (Mist. Fuscæ).

In prescription 448 will be seen an illustration of an almost hopeless case of incompatibility. There are no difficulties about making a solution of the quinine sulphate in sufficient water with the aid of the large quantity of citric acid ordered. If the potassium iodide, syrup of ferrous iodide, and tincture of iodine are now added, a reddish precipitate occurs, which probably consists largely of insoluble quinine iodide. The addition of two ounces of mucilage will not only be admissible, but even beneficial as an aid in holding up the precipitate and in blunting the edge of the excess of acid. Quinine sulphate should never be prescribed in combination with iodides, and particularly with excess of iodine; and the physician should be asked to revise such a prescription.

FIG. 447.

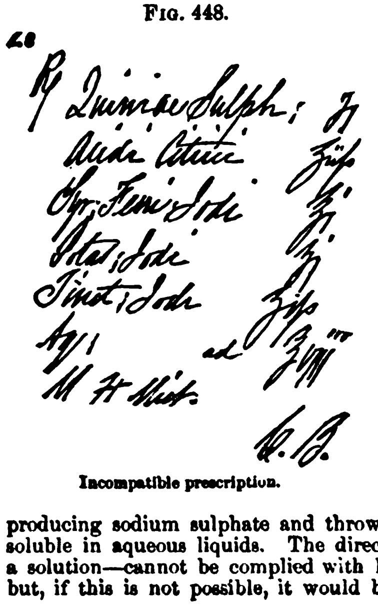


Illegible prescription.

Fig. 449 is a fac-simile of a prescription which should at once arouse the cautionary instinct of the compounder. It reads, "One grain of quinine sulphate, eight grains of morphine sulphate; make into ten pills. One pill every three hours." Through a lapsus the prescriber has written the quantity intended for the quinine sulphate after the morphine sulphate, and *vice versa*. The usual rule should be followed: gain time, if possible, and notify the physician; if this cannot be done, take the risk, use safe quantities, and inform the prescriber.

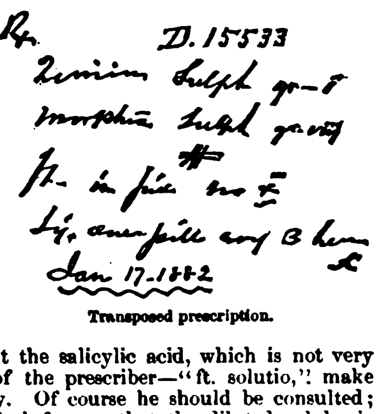
In Fig. 450 there is shown a prescription which affords an illustration of chemical incompatibility. Quinine salicylate is not a very soluble salt, and when strong solutions of quinine sulphate and sodium salicylate are mixed, quinine salicylate precipitates. The prescriber has evidently added diluted sulphuric acid with the view of dissolving the quinine salt, but the excess of acid will decompose the sodium salicylate,

FIG. 448.



Incompatible prescription.

FIG. 449.

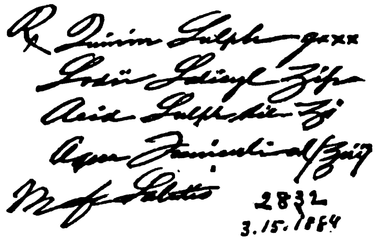


Transposed prescription.

producing sodium sulphate and throwing out the salicylic acid, which is not very soluble in aqueous liquids. The directions of the prescriber—"ft. solutio," make a solution—cannot be complied with literally. Of course he should be consulted; but, if this is not possible, it would be a fair inference that the diluted sulphuric

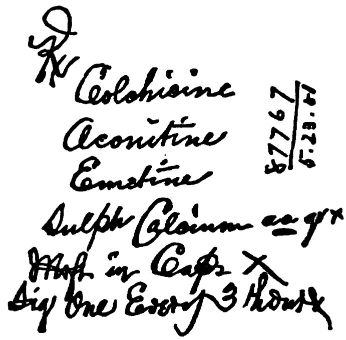
acid was intended solely for its action on the quinine sulphate to increase its solubility; but, as it acts as an impediment by decomposing the sodium salicylate, it might be omitted. If this course is not permissible, the mixture should be made in a mortar and the clear liquid then separated from the precipitate; the latter may be rubbed into a smooth paste with the aid of some mucilage of acacia and mixed with the rest of the liquid. This will make a mixture, and it should be dispensed with a shake-label.

FIG. 450.



Incompatible prescription.

FIG. 451.

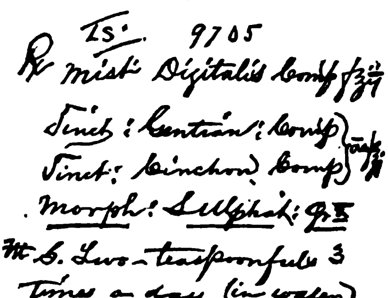


Toxic prescription.

Prescription 451 is a fac-simile of one written by a medical student. The ingredients are distinctly indicated; but the dose of the poisonous alkaloids is so heroic and the prescription itself so unusual that very little risk is incurred of the patient being poisoned. No dispenser who would be likely to compound such a prescription would have such alkaloids in stock. The only course to pursue here is to gain time and return the prescription to the prescriber for correction. Ten grains each of colchicine, aconitine, emetine, and calcium sulphate are to be made into ten capsules, and one given every three hours.

Fig. 452 is a type of a prescription not uncommon. Care and good judgment are required to pilot the compounder through safely. It might be surmised that the first ingredient was intended for "compound infusion of digitalis," but this is not the case,—the "compound mixture" being a preparation devised by the physician and the formula not published, the intention being to send the patient to a special drug-store to have it compounded, the druggist of course having been previously supplied with the private formula. This practice is common in some localities; it does not follow, however, that the physician always derives a pecuniary consideration through the method, although where the practice prevails both prescriber and compounder are soon suspected of pocketing some special profit. If the physician makes the private formula public or gives the patient the opportunity of going to a large number of pharmacists to whom he has given the formula, he is relieved of what is probably an unjust suspicion. The dose of morphine sulphate is a large one, but the underscoring of the line indicates that the prescriber has considered the likelihood of the compounder's questioning it, and he has underscored the words so that the compounder knows that the prescriber intended to give an unusually large dose. Under the circumstances there is no impropriety in dispensing it. Some careful pharmacists would prefer to decline such a prescription on the ground that they did not have the formula of the private preparation, the real reason being their unwillingness to incur the risk of dispensing so large a dose of morphine sulphate. Formulas for private preparations may often be secured through professional courtesy by applying to the pharmacist known to have them.

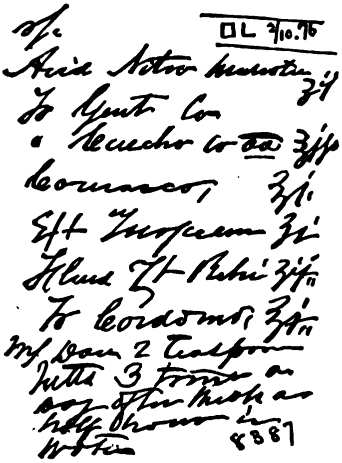
FIG. 452.



Questionable prescription.

The fac-simile Fig. 453 shows the prescription of a physician who at one time had an extensive practice, but whose early education had been seriously neglected. The ingredients are—Two drachms of nitro-muriatic acid, one and a half ounces each of compound tincture of gentian and compound tincture of cinchona, one ounce of Curaçoa cordial, one drachm of extract of taraxacum, two drachms of fluid extract of rhubarb ("rehi"), one ounce of tincture of cardamom. Dose, two teaspoonfuls, three times a day, after meals a half-hour, in water.

FIG. 453.

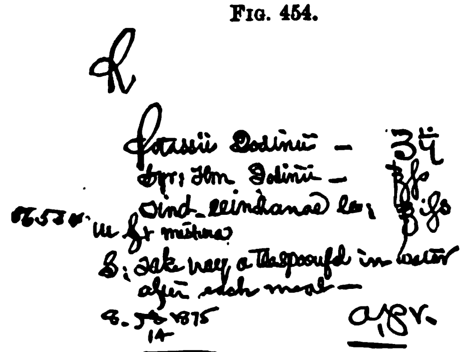


Illiterate prescription.

Prescription 454 illustrates two kinds of incompatibility. Two drachms of potassium iodide, half a fluidounce of syrup of ferrous iodide, and one and a half fluidounces of compound tincture of cinchona are to be made into a mixture. Take half a teaspoonful in water, after each meal. Potassium iodide is usually crystallized by the manufacturer from an alkaline solution, and traces of the potassium hydrate which is present in the mother liquor are retained by the crystals. The hydrate, by contact with the air, containing carbonic acid, becomes potassium carbonate, and hence commercial potassium iodide always contains traces of carbonate, and the Pharmacopœia permits the presence of 0.1 per cent. of alkali. Hence it follows that when a solution of potassium iodide is brought in contact with syrup of ferrous iodide a greenish flocculent precipitate is produced which is ferrous carbonate. This may be filtered out without detriment to the prescription. The other instance of incompatibility is inexcusable. Iron salts produce with preparations of cinchona bark blackish, inky precipitates, due to the reaction between the tannin in the cinchona and the ferrous iodide. Filtration will not remedy this fault, and there is usually no recourse but to dispense the prescription with a shake-label.

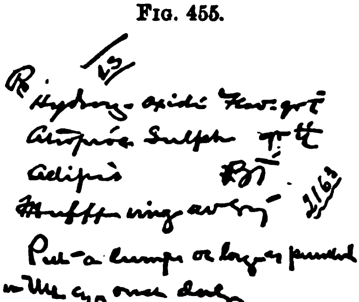
In prescription 455 the principal interest centres in the directions to the patient. One grain of yellow mercuric oxide, two grains of atropine sulphate, and one

FIG. 454.



Incompatible prescription.

FIG. 455.



Badly-written prescription.

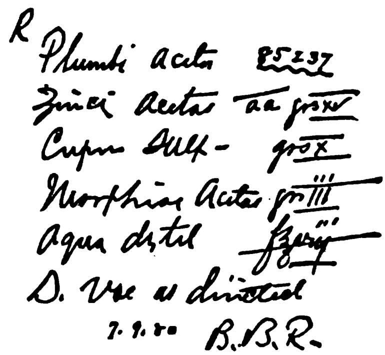
drachm of lard are to be made into an ointment. The prescriber intends that the patient should "put a lump as large as a *pin's head* in the eye once daily." If the label had been written according to the first reading of the compounder,—*i. e.*, put a lump as large as a *peanut* in the eye, etc.,—there would undoubtedly have been a serious time for all,—patient, physician, and pharmacist.

Chemical incompatibility is illustrated in Fig. 456; and whilst the compounder may believe that the prescriber has erred, through ignorance of the fact that sulphates are delicate reagents for lead salts, the absence of directions for use makes

it impossible for him to obtain any clue. The presence of lead sulphate may have been expected and desired by the physician. In such cases the only course is to compound the prescription exactly as it is written and dispense it, without filtering, with a shake-label. Fifteen grains each of lead acetate and zinc acetate, ten grains of copper sulphate, and three grains of morphine acetate are to be dissolved in eight fluidounces of distilled water. Use as directed.

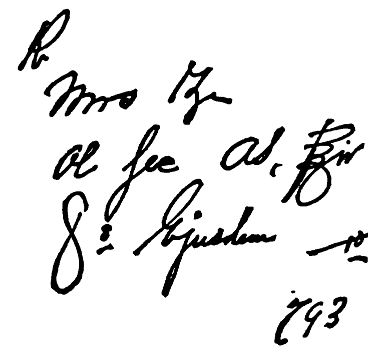
Fig. 457 shows peculiarity and brevity. It is expected that Mrs. Z. will receive four fluidounces of cod-liver oil and that the bottle will be labelled the same. Oleum

FIG. 456.



Incompatible prescription.

FIG. 457.

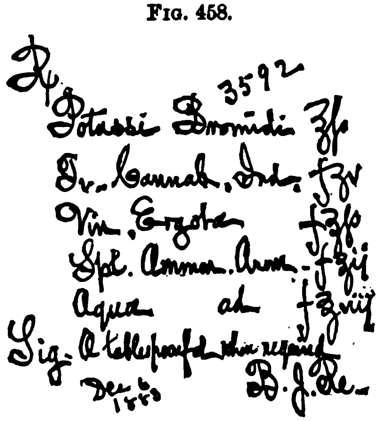


Curious prescription.

Jecoris Aselli is one of the synonymes for Oleum Morrhuæ, and the Latin word "Ejusdem," used in this connection, is a short but peculiar way of directing the compounder how he is to label the bottle.

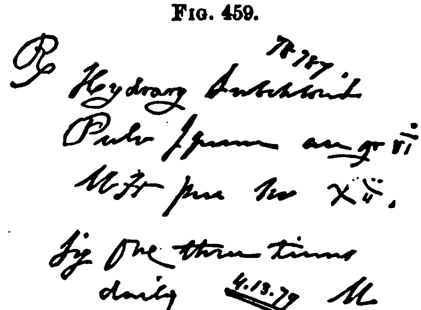
Although prescription 458 is rather flourishing in its style, no fault can be found with its legibility. Half an ounce of potassium bromide, five fluidrachms of tincture of cannabis indica, half a fluidounce of wine of ergot, two fluidounces of aromatic spirit of ammonia, and sufficient water to make eight fluidounces. The chief interest in it is due to the presence of the tincture of cannabis indica. If the prescription be compounded without this, and if a drachm of granulated acacia be placed in a mortar and rubbed with sufficient of the liquid to form a thick paste and the tincture then gradually and slowly added, it will be found that the resinous matter in the cannabis can be uniformly suspended, and when this is mixed with the rest of the liquid a very satisfactory preparation will have been produced. It should of course be dispensed with a shake-label.

FIG. 458.



Legible prescription.

FIG. 459.

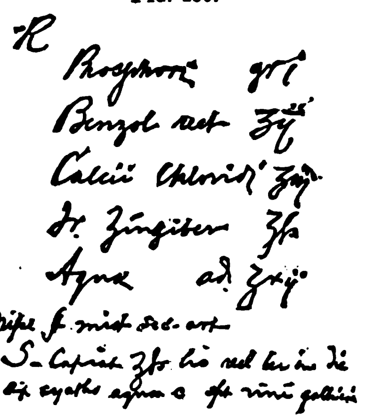


Questionable prescription.

Fig. 459 is a fac-simile of a prescription written by an old practitioner. Hydrar-

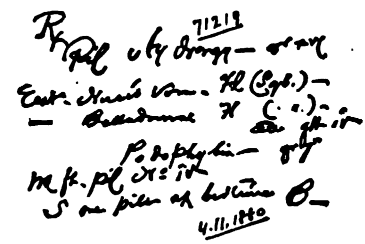
gyri subchloridum is rather an old name for calomel, but not uncommon. Six grains each of calomel and powdered ipecac are to be made into either twelve pills or twelve powders, and the question is, which? A little study of the prescriber's method shows that he has fortunately acquired the habit of dotting his "i's," and it is fair to presume that if pills were intended he would have dotted the "i" in the word. M. ft. *pul.* No. xii. is undoubtedly the correct reading. A few suggestive questions to the patient, such as—"Did the doctor direct you to take water with these?" or, "Were these to be taken after meals?" will be apt to elicit such a reply as this: "Yes, he said that I should take one *powder* three times a day, just before meals."

FIG. 460.



Odd prescription.

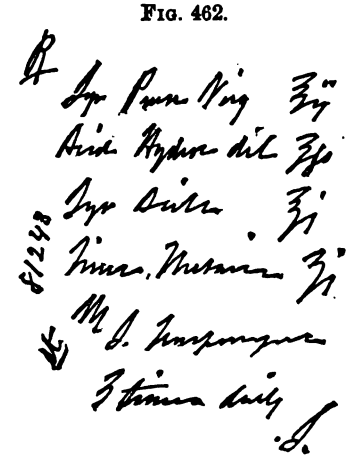
FIG. 461.



Faulty prescription.

Prescription 460 belongs to a class fortunately rare. The intention of the prescriber is undoubtedly to give phosphorus in a fine state of division, suspended in the mixture. This may be accomplished by dissolving the phosphorus in the benzol (not petroleum benzin), and, having made a thick mucilage of acacia from one drachm of gum, the solution of phosphorus may be gradually added with stirring, followed by the tincture of ginger and the chloride of calcium, dissolved in a little water. The directions to the compounder—Misce, ft. mist. sec. art. (make a mixture according to art)—indicates that the prescriber offers the pharmacist an opportunity to exercise his skill in making a good mixture. The directions for the patient are in Latin, the translation being,—"Let him take half a fluidounce, two or three times daily, in a cup of water, with brandy."

FIG. 462.



Badly-written prescription.

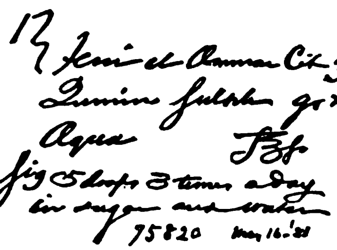
Fig. 461 is a fac-simile of a prescription written by a prescriber of large experience. Sixteen grains of mercurial mass, and one grain of podophyllin, with four drops each of fluid extract of nux vomica and fluid extract of belladonna (Squibb's), are to be made into four pills. As blue mass is usually soft in consistence, it will be necessary to evaporate the fluid extracts. This may be easily done by heating a small mortar, and, after dropping the fluid extracts into it and stirring them a short time with the pestle, the blue mass and podophyllin can be subsequently added and four pills made from the mass. The reason for prescribing fluid extracts when extracts are available is not apparent.

Fig. 462 shows a prescription which is faulty in several respects. In the second line the abbreviation is questionable. Is diluted hydrochloric or diluted hydrocyanic acid desired? It would be fair to assume that diluted hydrocyanic acid is wanted, because of its action as a sedative; and this is undoubtedly a cough mix-

ture and the prescriber desires to reinforce the action of the syrup of wild cherry. The style of writing is anything but legible, and the use of an unusual term for "opium" in the fourth line adds to the difficulties. Two ounces of syrup of wild cherry, half a drachm of diluted hydrocyanic acid, one ounce of syrup of squill, and one drachm of tincture of opium (tinctura thebaicæ). Teaspoonful three times daily.

Prescription 463 brings up an interesting question about which there may be more than one opinion. One drachm of iron and ammonium citrate and fifteen grains of quinine sulphate are to be made into a solution with half a fluidounce of water, and five drops are to be taken three times a day, in sugar and water. If no acid be used, it will not be easy for the patient to comply with the prescriber's directions to take five drops, for the insoluble portion of the quinine sulphate will separate, and the dropping, if each drop is to contain its proper proportion of quinine, will be very defective. If the directions were different and the patient could secure a fair dose each time, it probably would be best not to make an addition of acid; but in this case there could be no impropriety in making a solution of the quinine sulphate in the water with a trace of acid (citric acid, if preferred), and then dissolving the iron and ammonium citrate in the solution. The practice of adding acids or alkalies to prescriptions generally and upon very little provocation is a bad one, and the author would not be understood as encouraging the habit; but occasions occur when there should be no hesitation about employing a trace of acid or alkali when the compounder is satisfied that the intention of the prescriber will not be frustrated. Of course the risk of making an error in judgment must be taken; but "first be sure that you are right, and then—do right."

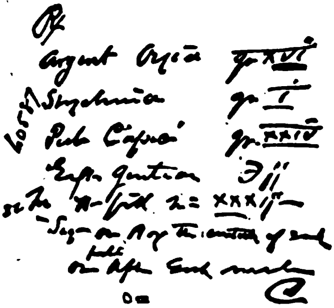
FIG. 463.



Imperfect prescription.

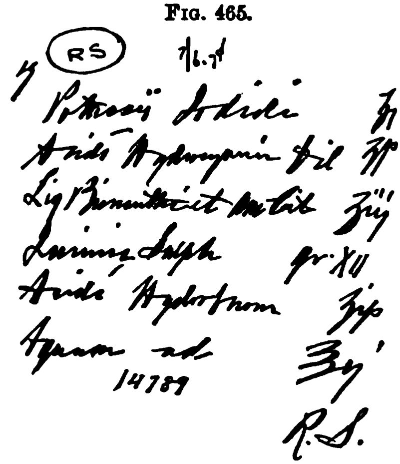
Fig. 464 is a fac-simile of a prescription for pills. Sixteen grains of silver oxide, one grain of strychnine, twenty-four grains of powdered capsicum, and forty grains of extract of gentian are to be made into thirty-two pills. If these pills are made in the ordinary way, with an excipient of syrup, glucose, or similar liquid, the pills will be very apt to explode, owing to the decomposition of the silver salt. The directions are not very legible, but it is not difficult to read,—Sig. on box the contents of *each* pill. One after each meal. The prescriber would probably be satisfied if the contents of *one* pill were written on the label; he certainly does not intend that the contents of *thirty-two* pills be so written, although this is what he directs.

FIG. 464.



Explosive prescription.

FIG. 465.

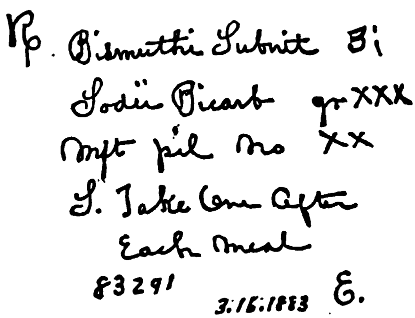


Incompatible prescription.

Prescription 465 is a strange mixture, thrown together in opposition to the laws of chemical combination and compatibility. The quinine will be precipitated through

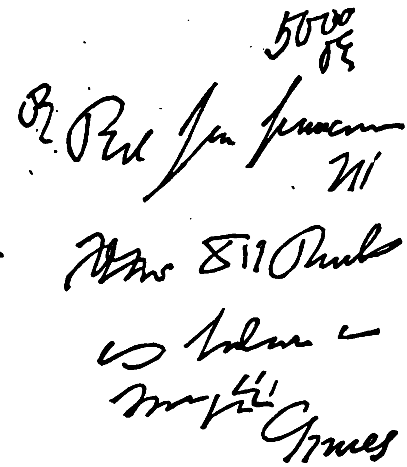
the formation of a double bismuth and potassium iodide,—a precipitant for alkaloids, sometimes used as a reagent. The presence of the hydrobromic acid aids in the precipitation, instead of dissolving the precipitate. The translation is,—One drachm of potassium iodide, half a drachm of diluted hydrocyanic acid, three drachms of solution of bismuth and ammonium citrate, twelve grains of quinine sulphate, one and a half drachms of hydrobromic acid, and sufficient water to make two ounces. The only course to pursue is to dissolve the quinine salt in four drachms of water containing the hydrobromic acid, dissolve the potassium iodide in the remainder of the water, and add the other ingredients.

FIG. 466.



Doubtful prescription.

FIG. 467.



Illegible prescription.

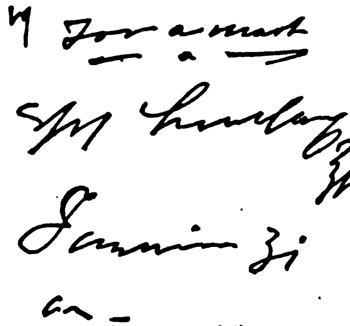
Prescription 466. Pills made from bismuth subnitrate and sodium bicarbonate have been known to explode, owing to decomposition in the sodium bicarbonate from acid in the bismuth salt, carbonic acid being liberated. Of course no explosion can take place if the pills are not dispensed in a tightly-corked vial or other container which will not permit of the escape of the liberated gas. Risk of explosion may be obviated by piercing the lid of the pill-box with a few holes; but the pills may swell to an enormous size, due to the non-escape of the gas.

Prescription 467 is a fac-simile of one written by a noted physician. One other specimen of his handiwork may be seen on page 1152. The translation is,—Two drachms of powdered gum guaiacum. Make twelve powders. One taken at night.

In concluding these comments it may truly be said that the necessity for more care in writing prescriptions has been unquestionably proved by abundant evidence. Physicians have in many cases grown careless in this respect, often relying upon the proverbial caution and self-interest of the pharmacist to correct errors or supply deficiencies, and whilst the additional responsibility thus thrust on the compounder has a tendency to develop his faculties, it does not lighten his cares, nor is it labor which is appreciated by the prescriber, who usually regards the service as quite within the routine of the pharmacist's duties, and the latter is expected, as a matter of course, to check errors and decipher scrawls with ease, and, on the other hand, there are often occasions when great haste must be exercised in writing a prescription; and, in addition, it should be remembered that it frequently happens that the physician is harassed by many annoyances and interruptions whilst writing the prescription. These circumstances, coupled with the gentlemanly instincts which all true pharmacists are credited with possessing, should exercise their proper restraining influences upon the latter whilst undertaking the mission of interviewing the physician upon a subject which is often mortifying to him. It is impossible to conduct an active business without encountering occasions which require the exercise of much forbearance and tact, and the reflection that both physician and pharmacist are *at all times* human, and hence liable to err, should prevent either from indulging in expressions detrimental to the good name of the other. In the unusual instance of a physician taking umbrage when a judicious course has been followed by the pharmacist in correcting his mistake, a firm and dignified defence should be at once made by the latter, and maintained with spirit, but not in the presence of the patient if it can possibly be avoided.

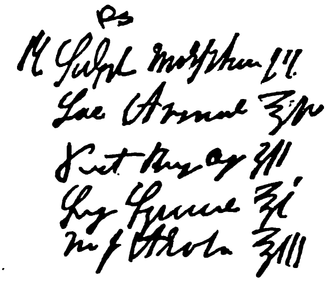
The prescriptions upon the following pages are submitted without comment, with the view of affording the reader an opportunity for individual practice.

FIG. 468.



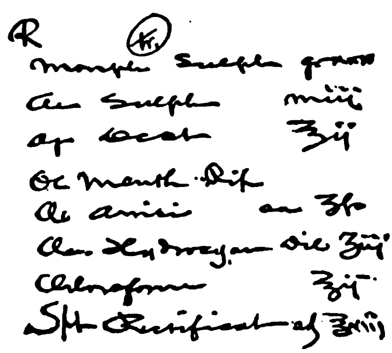
Obscure prescription.

FIG. 469.



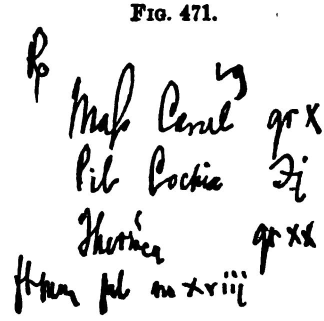
Illegible prescription.

FIG. 470.



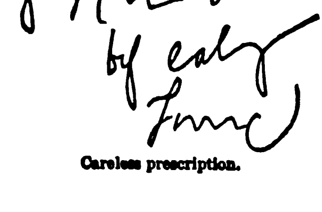
Difficult prescription.

FIG. 471.



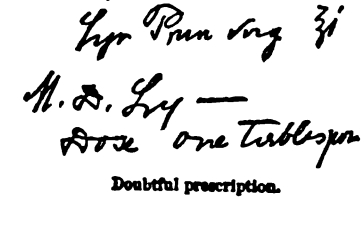
Antique prescription.

FIG. 472.



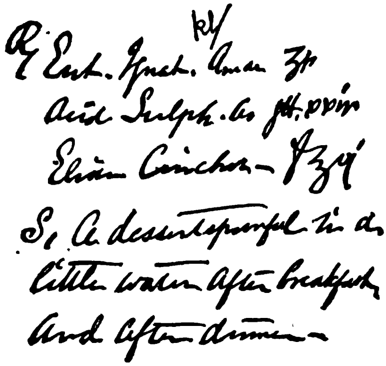
Careless prescription.

FIG. 473.



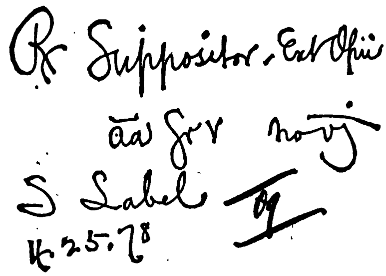
Doubtful prescription.

FIG. 474.



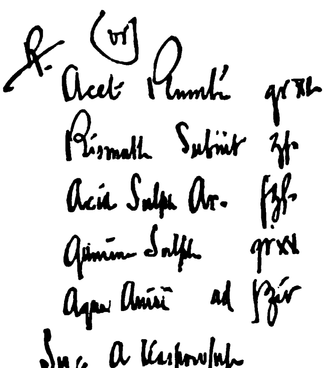
Questionable prescription.

FIG. 475.



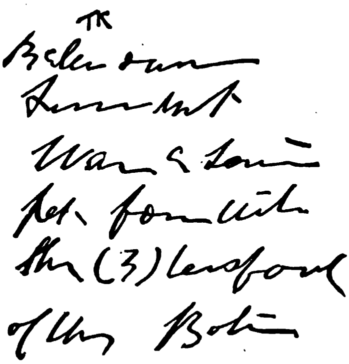
Erroneous prescription.

FIG. 476.



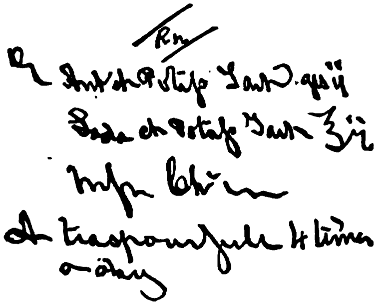
Incompatible prescription.

FIG. 477.



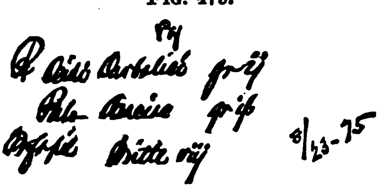
Illegible prescription.

FIG. 478.



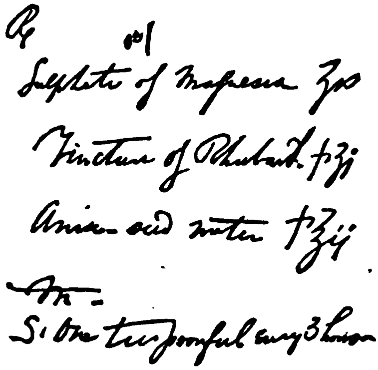
Odd prescription.

FIG. 479.



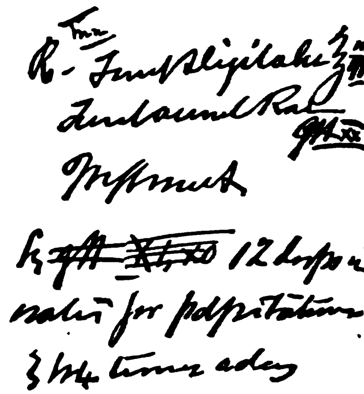
Difficult prescription.

FIG. 480.



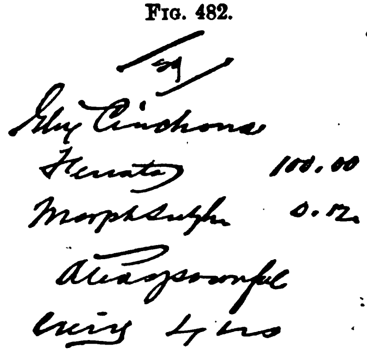
Doubtful prescription.

FIG. 481.



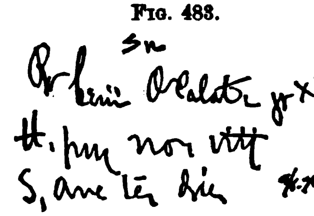
Erroneous prescription.

FIG. 482.



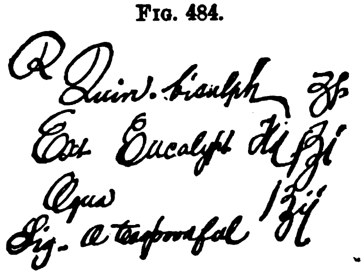
Metric prescription.

FIG. 483.



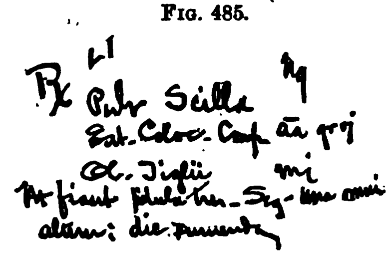
Questionable prescription.

FIG. 484.



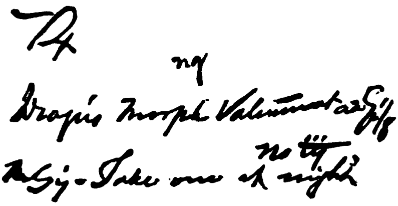
Incompatible prescription.

FIG. 485.



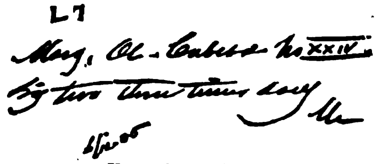
Difficult prescription.

FIG. 486.



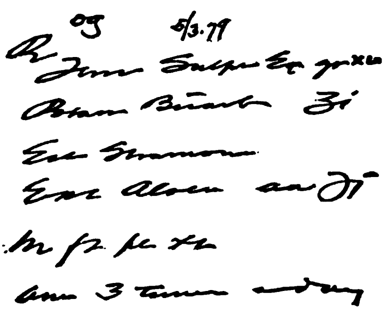
Safe prescription.

FIG. 487.



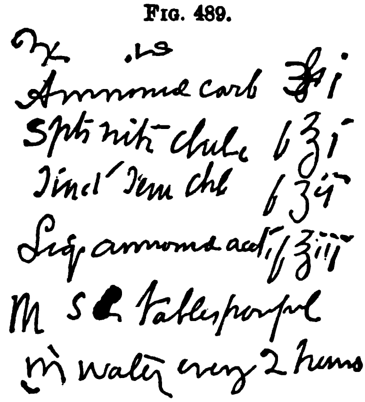
Unusual prescription.

FIG. 488.



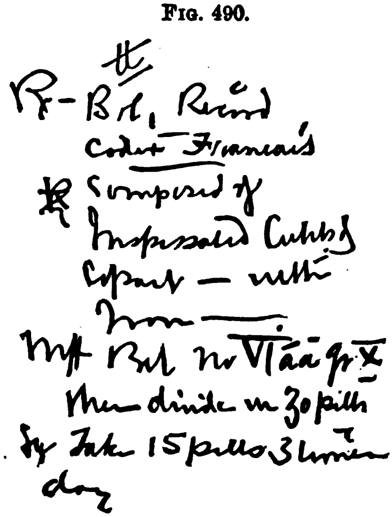
Difficult prescription.

FIG. 489.



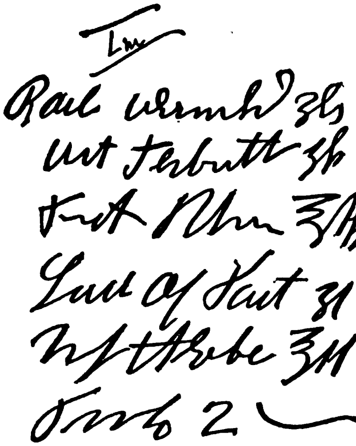
Incompatible prescription.

FIG. 490.



Unusual prescription.

FIG. 491.



Illegible prescription.

METRIC PRESCRIPTIONS.

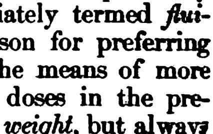
The growth of the metric system has made it necessary for every pharmacist to be acquainted with the methods employed in writing metric prescriptions.

There are two distinct methods employed in this country, which may be termed respectively the *gravimetric* and the *volumetric* method.

1. **Gravimetric Prescriptions.**—The gravimetric principle of weighing liquids is used in Germany and some other Continental countries almost exclusively. It was adopted by the U. S. Pharmacopœia of 1880, and given the name of "parts by weight;" but, although weighing liquids may be practised with advantage in the laboratory in making large quantities of preparations, and is preferable in the case of thick or adhesive liquids, it is far less convenient in compounding prescriptions than the plan of measuring the liquid ingredients. The advantage in supposed greater accuracy of weighing over measuring is more imaginary than real. A careful pharmacist will compound prescriptions just as accurately by measuring the liquids as he will by weighing them, whilst a slovenly one will be just as careless in using weights as he is in measuring liquids. The question of accuracy becomes then, practically, a "personal equation."

Several conveniences have been proposed in weighing liquids, which deserve notice. The Germans use a "tare-can" (see Fig. 492) for the purpose of quickly taring a bottle. It is a small metallic can having a shallow funnel-mouthed opening, with two spouts, one on each side. The bottle, or vessel, is placed on one of the scale-pans, and the tare-can, containing sufficient shot or clean dry sand to balance it, is placed upon the other. It is better, however, to use two tare-cans and pour from one to the other, the one not in use on the scale-pan either receiving the excess of shot or supplying the deficiency.

Fig. 492.



Tare-can.

2. **Volumetric Prescriptions.**—In these the gramme is replaced by the cubic centimetre, which has been very appropriately termed *fluigramme* by Mr. A. B. Taylor. The principal reason for preferring the volumetric method is that the physician has the means of more readily calculating and apportioning the number of doses in the prescription. *Liquid medicines are never administered by weight,* but always by teaspoonfuls, tablespoonfuls, or other convenient measure. In some liquids there is a wide difference between their weight and their volume, as the specific-gravity tables abundantly show. A teaspoonful of ether weighs forty-one grains, whilst a teaspoonful of chloroform weighs eighty-five grains (more than twice as much): hence the physician cannot disregard specific gravity. In prescribing gravimetrically and administering volumetrically he must constantly bear in mind these differences, at least approximately. Mistakes are very likely to arise in making these calculations, mentally, at the bedside of a patient: hence it is far better to avoid them by *prescribing the medicines by the same method as that by which they are dispensed and administered, namely, volumetrically,* and thus preserving that harmony of relation which is

conducive to safety. If volumetric analysis is preferred to stathmetic or gravimetric analysis in the U. S. Pharmacopœia because of its greater convenience and at least equal accuracy, why should not liquids be measured rather than weighed in pharmaceutical operations in which extreme accuracy is comparatively of less importance?

The following examples illustrate the forms of metric prescriptions most frequently used. Form A is preferable, for the reasons stated:

Form A.

℞ (*Volumetric.*)

Gm. and C.c.

Quininæ Sulph. . .	1	
Strych. Sulph. . .		016
Ext. Glycyrrh. Fld.	4	
Syrupi	60	

A teaspoonful three times a day.

℞ (*Gravimetric.*)

Hydrarg. Chlor. Mit.		5
Pulv. Aloes	2	
Pulv. Rhei	1	5

Make twenty pills.

The advantages of the decimal line are that the decimal dot is abolished, with its dangerous complications, for a spot or a fly-speck on the prescription-paper may increase or decrease the quantity of an ingredient *ten times*, and the use of the decimal line is familiar to all who use a dollar and cents column.

Form B.

℞ (*Gravimetric.*)

Quininæ Sulph. . .	1.
Strych. Sulph. . . .	.016
Ext. Glycyrrh. Fld. .	4.
Syrupi	60.

A teaspoonful three times a day.

℞ (*Gravimetric.*)

Hydrarg. Chlor. Mit.	.5
Pulv. Aloes	2.
Pulv. Rhei	1.5

Make twenty pills.

This form is used frequently, because of the familiarity with the arithmetical method of using a dot to denote a decimal fraction; and where metric prescriptions are altogether in use, as in Continental Europe, there is no necessity for indicating the denomination, gramme being always understood.

Form C.

℞ (*Volumetric.*)

Quininæ Sulph.	1.	Gm.
Strych. Sulph. .	.016	$\underline{\underline{\text{Gm.}}}$
Ext. Glycyr. Fld.	4.	$\underline{\underline{\text{C.c.}}}$
Syrupi	60.	$\underline{\underline{\text{C.c.}}}$

A teaspoonful three times a day.

℞ (*Gravimetric.*)

Hydrarg. Chlor. Mit.	.5	Gm.
Pulv. Aloes. . . .	2.	$\underline{\underline{\text{Gm.}}}$
Pulv. Rhei	1.5	$\underline{\underline{\text{Gm.}}}$

This form is an improvement on Form B, and would be far superior to it for use in this country, where prescriptions written in the old systems will long continue to be used; for next to writing out in full the word *gramme*, the indication of the unusual quantity by underscoring will prevent its being mistaken for *grain*.

The Art of Dispensing and Compounding.

The practical work embraced in the ever-varying labors of dispensing and compounding constitutes a more searching test of the adaptability and qualifications of the pharmacist than any other duty that he is called upon to perform. Careful training, tact, and much experience are needed to meet the requirements of this branch of the profession.

Receiving the Prescription or Order.—This apparently simple matter, if not carefully considered, is frequently the source of embarrassing mistakes. Very few customers, even if they are intelligent, realize the necessity of forethought or care in calling for any articles that they wish: hence it is an excellent practice for the dispenser to *repeat the order* interrogatively at the time that it is given, and obtain from the customer a clearly-expressed assent before delivering the article, lest the wrong one be dispensed. If it is a poisonous substance, the use that is to be made of it should be carefully inquired into, and in all cases a written order, properly dated and signed, should be required. The best plan is to have a regular poison book, in which the record is made. Poisonous or dangerous substances should never be dispensed to children or minors without a written order, and even then the receiver should be cautioned about the contents.

The following prescription memorandum, which is similar to one suggested by Andrew Blair, has been in use several years by the author with excellent results. These blanks are put up in tablet form, and are filled in in the presence of the customer, or the back of the prescription may be used for noting the points when it is handed in.

MEMORANDUM.

Name.
Address.
Is it paid for?
Is it to be charged?
Is it to be called for?
Is it to be sent?
Received by
Compounded by
Number of ℞ and Price.

It is the custom in some pharmacies, when a number of prescriptions are being compounded at one time, to use what is known as the check system. Brass or nickel-plated checks or disks, numbered or lettered, are used: the customer upon handing the prescription is given a check, which he holds until the prescription is ready; the receiver marks the corresponding number or letter upon the prescription, and when he delivers the bottle or package receives back from the customer the original check containing the same number or letter. This system is not without faults; indeed, unceasing vigilance is absolutely necessary, and it is not safe to place faith in any system.

The prescription should be received with becoming dignity by the compounder, and questions answered with cheerful politeness, especial care being taken to do or say nothing that would impair confidence. Unseemly jesting, loud conversation, or boisterous mirth is entirely out of place here, whilst especial regard should be paid to the feelings of those who may have just left the sick-chamber or the bedside of one who is dear to them. In such cases every word and movement of the dispenser is often carefully watched, and, whilst ordinarily the customer may be disposed to judge seeming slowness or indifference leniently, at such times these faults become unbearable to the impatient and anxious messenger.

Reading the Prescription.—The prescription should be read over carefully, and judgment mentally pronounced, first upon the safety of the doses of the respective ingredients, and then upon their compatibility. If this reading be done in the presence of the patient, especial care should be taken that the countenance reveal nothing whatever of what may be going on in the mind of the receiver: a shrug of the shoulders, an elevation of the eyebrows, a contemptuous toss of the scrap of paper on the prescription desk, may convey to the mind of the patient a more lasting impression of the opinion of the receiver as to the merits of the prescription than open criticism. Questions are frequently asked by patients and requests made for opinions: these should always be skilfully parried. An apothecary has no right to reveal to a patient the character or the medicinal effect of the ingredients which enter into a prescription. When the names of the ingredients in the prescription are persistently demanded by the patient, the dispenser can fall back upon the expedient of frankly stating that it is a breach of etiquette to reveal the character of the ingredients, and intimating that

it shows a lack of confidence in the prescriber on the part of the patient; but, if further insisted upon, the offer to send to the physician a written request to get his permission to disclose the ingredients is generally answered by the patient with a gracious "no matter." The pharmacist, as a co-worker with the physician in the healing art, is ethically bound to sustain him and cheerfully co-operate with him, and there should be at all times a spirit of mutual respect between the members of both professions, and a feeling that each is in duty bound to protect the other from unjust censure.

In order to gain time in case of doubtful procedure, it is often good practice to write the label for the prescription as soon as it is received, and this will usually afford an opportunity to study the prescription whilst reading it. The only objection to this is that the patient very frequently misunderstands this manœuvre, and imagines that the dispenser is neglecting him and not proceeding at once to compound his prescription.

Compounding the Prescription.—The greater part of the succeeding chapter will be devoted to the details of this very important duty; in this place it is merely necessary to consider the general features. After thoroughly understanding the prescription and clearly deciphering it, a method must be quickly formulated for compounding it. In this connection, if there is any doubt about safety, the well-known aphorism, "When you do not know what to do, do nothing," has great force. The work of compounding must not go on in any feeling of uncertainty; the chance of causing death or serious consequences is too great to warrant the running of risks, and there is nearly always more safety in delay than in pushing forward doubtfully.

When a clearly-outlined plan of procedure is decided upon, the ingredients should be carefully weighed or measured and the process witnessed by a colleague. *The system of double checking prescriptions should be invariably followed wherever possible:* over-confidence and an indisposition to recognize the possibility of making a mistake have probably occasioned more loss of life in this responsible work than any other cause. Not only should the junior assistant cheerfully submit to having his work witnessed, but even the *preceptor* should insist upon one of his assistants checking off the ingredients and quantities which he has weighed or measured out himself, as a matter of principle and method. If this is not always possible, on account of there being but one present in the store, the system of single checking should be invariably practised: this is, briefly, to arrange upon the counter the shop-bottles or packages from which were taken the ingredients which entered into the prescription, and place the weights which were used immediately in front, then, when the preparation is finished, to check off from the prescription each ingredient in order, noting the weight or measure. Before permitting a prescription which is at all complicated to advance further in the process of compounding, each ingredient should be numbered in lead-pencil on the margin in the order in which it has been added. This memorandum becomes valuable when the prescription is to be renewed, because there will then be no likelihood of the renewed prescription differing from the original.

Additions or Alterations to Prescriptions by the Pharmacist.—At the present time it is the custom among physicians to hold the pharmacist responsible for the proper compounding of prescriptions intrusted to his care, and to depend upon him. Such details as the choice of the excipient, method of straining or filtering, etc., are usually not specified: indeed, with many it is a frequent practice simply to direct a solution or mixture of definite strength and rely upon the pharmacist to make it palatable. In all cases of this kind, care must be taken to make a note upon the prescription of each addition, so that in the event of renewal there may be no difference between the preparation then obtained and the original. The confidence which physicians place in pharmacists in this respect should be most sedulously guarded and every effort made to deserve and retain it. This can be done only by adhering strictly to the rule of *not permitting an alteration or addition to be made to a prescription which would affect or vitiate its proper medicinal action or interfere with the obvious intention of the prescriber.*

Numbering the Prescription.—It is the universal practice to number the prescription, and to place a corresponding number upon the label, the object being to identify the bottle or package in case of renewal and connect it with the original prescription. This apparently simple matter requires upon the part of the compounder concentration of thought to avoid errors,—one of the most frequent lapses being that of duplicating the number of the last prescription, instead of numbering it consecutively: this, in case of renewal, may lead to serious consequences, particularly if one prescription happens to be a four-ounce aconite liniment and the other a four-ounce solution for internal use of similar appearance. The duplication of the numbers is particularly liable to occur when several prescriptions are being compounded at the same time by two or more assistants. Various expedients have been proposed to obviate mistakes of duplication: one is to have a strip of paper about an inch wide numbered consecutively, rolled with the highest number inside, and placed in a round tin ointment-box which has a slit in the side to permit the end of the strip to appear; this may be hung in a convenient place and the number cut off and pasted on the prescription, or, if the location is one having a dry atmosphere, a gummed strip may be used. Another method is to arrange the numbers upon gummed sheets and bind them in book form, or glue the edges and use as tablets (see Fig. 493); in the latter case the numbers are printed in perpendicular columns, and the margins are perforated so that the outer strip from 1000 to 1009 may be torn nearly off, and each number then cut off with scissors or gently torn off as it is wanted.

FIG. 493.

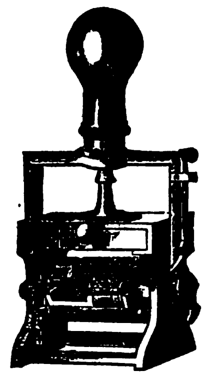
NUMBERING TABLET.			
1039	1029	1019	1009
1038	1028	1018	1008
1037	1027	1017	1007
1036	1026	1016	1006
1035	1025	1015	1005
1034	1024	1014	1004
1033	1023	1013	1003
1032	1022	1012	1002
1031	1021	1011	1001
1030	1020	1010	1000

Numbering tablet.

Consecutive Numbering Machines are also used; these are very convenient, and serve excellent purposes if they are properly and durably constructed. The best machine

known to the author is shown in Fig. 494: it is made in Vienna, and can be adjusted to number *automatically* either consecutively, repeatedly, in duplicate or in triplicate.

FIG. 494.

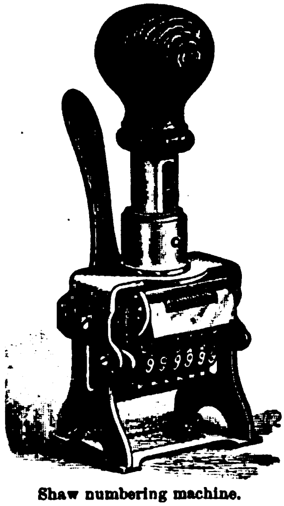


Numbering machine.

The usefulness of this machine to the pharmacist consists largely in the fact that it can be made to *number consecutively in duplicate* (13428, 13428; 13429, 13429, etc.), so that if a proper-sized machine is chosen (letter *b* is preferred) the number may be clearly and neatly printed upon *both prescription and label;* the machine may then be locked and set, so that there is not the slightest danger of variation or change in the method of numbering whilst in use. The value of a mechanical contrivance of this kind consists in its absolute freedom from mistakes, and in the entire elimination of chances of error from defective handwriting, the figures being printed from hardened steel disks, invariably producing clear and distinct impressions.

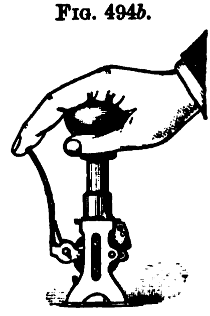
The Davis Novelty Company have placed upon the market the "Shaw Numbering Machine" (Fig. 494*a*). This is not so expensive as the Vienna machine, and is not automatic, but it is very ingenious. The figures are raised and cast upon six rubber bands, which revolve separately except when it is necessary for more than one to be moved; the machine is easily set at any number up to 999,999, and by holding it as shown in Fig. 494*b*, moving the lever towards the handle, and pressing the handle down, the rubber band is caused to revolve so as to print upon the paper the consecutive number. The inking is automatic.

FIG. 494*a*.



Shaw numbering machine.

FIG. 494*b*.



Rubber Numbering Stamps are also in use: these are cheaper than the consecutive numbering machines, and are very convenient. Fig. 495 shows one which combines with it a dater. These machines are not automatic, however: the numbers are cast upon endless rubber strips.

Fig. 496 shows a very simple and practical apparatus for numbering prescriptions and checking mistakes in numbering. It may be obtained from E. T. Ellis, Philadelphia, and consists of a rolled strip of paper (gummed or ungummed), fastened at one end upon an axis which is free to revolve in a cylindrical box. A double row of consecutive numbers is printed on the strip, and a slit in the edge of the box permits the unrolling of the strip over a knife-edge fastened on the outside.

Dating.—This also serves to fix the identity of a prescription, and it should never be omitted. The physician usually appends the date, but the prescription is frequently held by the patient and not presented for compounding upon the day on which it is written. As in the case of numbering, the date is most frequently written upon the face of the prescription by the pharmacist; and this should not be omitted, even though the date written by the physician be visible. The habit of dating should be firmly established, because it may prove of vital importance in case of a subsequent discussion or difference of opinion. *Rubber daters* are largely used now. Fig. 497 shows one furnished by Wm. H. Dietz, of Chicago. It is inexpensive, not liable to get out of order, and so convenient for prescription work that it soon pays for itself.

FIG. 495.

Rubber numbering stamp.

FIG. 496.

Safety prescription-numerator.

FIG. 497.

Rubber dating machine.

Pricing.—The price of the prescription must always be marked upon it: this is necessary in order to fix the sum in case of renewal. The price is usually not subject to variation, except in the case of a patient ordering a larger or smaller quantity of the prescription. In renewals, in all cases the increase or decrease should be noted distinctly, if future annoyance is to be avoided. Few occurrences are apt to create more distrust in the mind of the patient than a neglect of this precaution, the reasoning being that if the pharmacist is so careless as to have two prices for the same prescription, he probably has been careless in compounding it. The greatest objection arises, however, when the price asked is *greater* than that originally demanded.

It is usual for the pharmacist to adopt a cipher to show the price of the prescription, some word or combination of characters being selected

and memorized. If a word is selected, it should have ten letters, and there should be no duplicate letters, thus:

V	O	L	U	M	E	T	R	I	C	V.CC—$1.00; OM—25 cents, etc.
1	2	3	4	5	6	7	8	9	0	

The following words or phrases may be used as price-marks: Behaviour, chemistry, complaints, no mistake, come and buy, duplicates, republican, democrats, epistolary. A word with nine letters requires an odd letter, usually X. Sometimes a repeater, like X, is employed; thus, in volumetric, $1.00 would be V.CX.

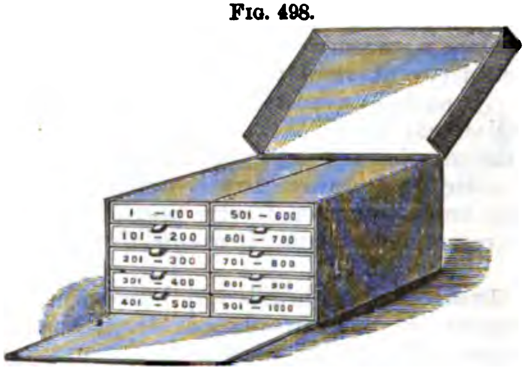
It frequently happens that physicians desire to indicate that a patient is poor and is a proper subject for charity: this is usually done by writing the letter P in the lower corner, or, if very poor, PP. It is customary and humane to regard these marks, if assured of their genuineness.

Filing, Binding, and Preserving.—There is very little uniformity of practice among pharmacists in the particulars of filing, binding, and preserving prescriptions. The usual practice is one which is most inconvenient,—*i.e.*, that of simply filing them away upon a long brass wire yearly, half-yearly, or quarterly. By this plan they are sure to become in time torn, dirty, dusty, and fly-specked, and the pile is very unsightly. The method of pasting them daily into a large invoice-book is an improvement: the objection to this plan is, however, that the backs of the prescriptions cannot be examined readily, and in an active business the unwieldy books soon accumulate so as to be an inconvenience. A ready method of binding prescriptions is furnished by the use of Mann's binder: this consists of two durable stiff covers having a wrought-iron strip riveted to the edge of each; two long screws are fastened to one of the strips; these pass through two screw-holes in the other strip, and the covers are kept in place by two adjustable brass cylinders split longitudinally in the centre, having a solid disk at the top with a screw-hole in the centre, and at the bottom the same kind of disk cut in two. The split cylinders are flared somewhat at the bottom, and are made to approach each other by a ring; by slipping this ring down, the edges of the bisected disks are brought together, and these can then be screwed down so as to hold securely; they can be instantly released, however, by pushing the ring up. The advantage of this binder is that it can be so readily converted into a temporary or a permanent binder. One month's prescriptions can be placed upon one screw by punching out a hole in the side of the prescription with a circular punch, and another month's upon the other screw; then, if the solid disks are screwed to the ends of the screws projecting from the screw-holes, the brass cylinders can be broken off, and the volume for two months is completely bound; a stout piece of muslin should now be glued to the backs, and a finish given to the binding by gluing upon this a strip of red leather, labelled distinctly with the first and the last number of the prescriptions.

Many pharmacists copy their prescriptions into a book kept for the purpose. This plan is not always a judicious one: the chances of making errors are increased, and, in case of dispute, proof of the correctness of the copy would have to be produced.

Fig. 498 shows a box for holding cases containing numbered prescriptions made by J. F. Lawrence, of Chicago. The cases are numbered on the edge so that their contents can be easily referred to.

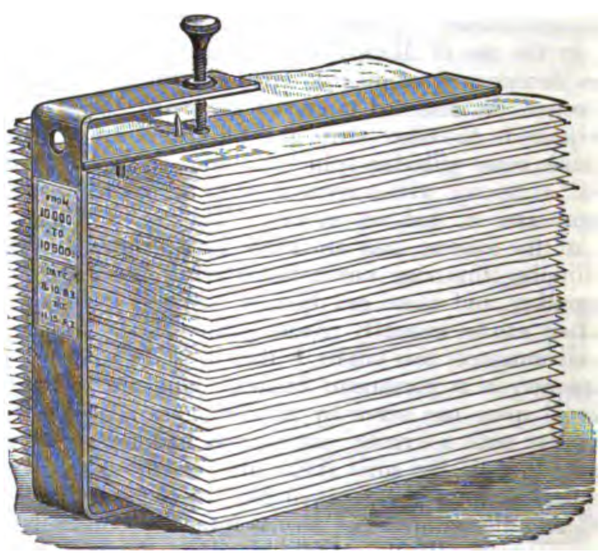
Fig. 498.



Lawrence's prescription-box.

Fig. 499 represents a prescription-file devised by R. H. T. Nesbitt, of Leavenworth, Kansas. The prescriptions are retained in place by the movable flat iron bar which is represented upon the top of the file. A pointed wire passes upward from the bottom of the frame, and the prescriptions are filed upon it in the ordinary way; the movable iron bar may be screwed down upon the pile, and they are thus kept in place. When a prescription is to be renewed and access to one of those in the pile is desired, the bar is raised by means of the

Fig. 499.



Nesbitt's prescription-file.

screw and the prescription turned sideways and read. The hole seen in the frame near the top of the side is for hanging the file on a nail.

Anderson's prescription-file, box-file, and cabinet are shown in Figs. 500, 501, and 502. The object of this invention is to provide a means for collecting, protecting, and preserving prescriptions. In Fig. 500 the

file-holder is shown; this is intended to serve for the collection of the prescriptions as they are received. It is represented as partly filled with prescriptions. The bottom of the slide is of wood and is securely fastened to the tin front and side. In the corner is placed a hollow pin, on which the prescriptions are filed. Each file is supplied with ten index cards,

FIG. 500.

Anderson's file-holder.

FIG. 501.

Anderson's box-file.

numbered from "100" to "1000." These cards are intended to be placed between each hundred prescriptions, to facilitate the finding of a prescription when it is to be refilled. If it should be desirable to remove a prescription from the file, it may be readily done by inserting the transfer wire into the hollow pin and removing on the wire all prescriptions from above the one desired, which can then be removed by itself. When a prescription is to be renewed, it is turned to the left, as shown in the illustration, thus exposing it thoroughly for reading. The case is preferably made of tin in order to protect the prescriptions from dust, moisture, mice, and insects.

FIG. 502.

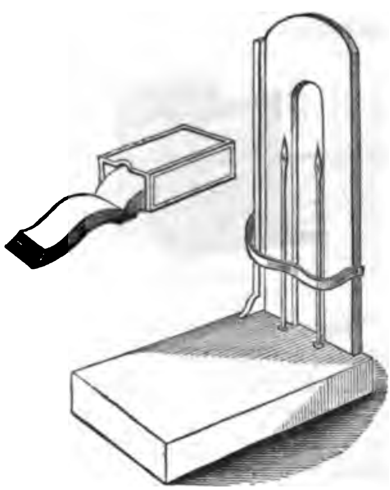
Anderson's filing cabinet.

Fig. 501 represents a front and side view of the file. A punch is used to cut a clean round hole in each prescription. A perforation without ragged edges constitutes one of the most important details in filing prescriptions, for it permits the prescriptions to lie flat upon each other, thus taking up less room, and the prescriptions are not likely to be mutilated if they are free to slip easily around the filing wire. A place is provided upon the top of the cover for the punch, so that it may always be kept within reach.

Fig. 502 shows a cabinet which is designed to permanently store the prescriptions after the box-files are full. Upon the front of each box-file there are two depressions, intended to hold blank cards to be used for the numbers of the first and last prescription.

The cabinet will accommodate fifteen box-files; and as each file is capable of holding 1000 prescriptions, it will be seen that the capacity of the cabinet is 15,000 prescriptions. The drawers are of wood, and are of the same design as the slide in the single file.

FIG. 502a.



Naulty's prescription-file.

Naulty's Prescription-File is shown in Fig. 502*a*. The prescriptions are held securely upon two needles in such a position that for reference they can be found quickly and an unobstructed view obtained whilst compounding, the band shown in the cut being used for holding the succeeding prescriptions up. When a month's prescriptions, or any desirable number, have been filed, the needles are threaded with strong twine, and the pile pulled carefully off, the twine passing through the holes; the ends of the twine are now secured and a piece of thick muslin glued upon the back, and the back dated and numbered: the books are then placed in boxes, which are likewise numbered and dated distinctly. The cut also illustrates the method of keeping the bound book open whilst compounding a prescription.

LABELS.

It should be an invariable rule, in dispensing, that *every medicinal substance* sent out from the store *must have* a neat and distinct label upon it. It is necessary to establish this rule as a fixed custom or habit, for neglect of this precaution will often result in serious consequences. In addition, every package *should be labelled at once*, particularly in the case of prescriptions: the habit of permitting unlabelled packages to remain about, liable to substitution, will inevitably cause doubt, and give rise to some grave mistake, sooner or later. A very great diversity of opinion and taste is apt to prevail with regard to the most suitable style of label to select for general use: formerly the home printer was exclusively depended upon, but the principle of division of labor has led to the establishment of "druggists' printing-houses" in several sections of the country; this has resulted in cheapening labels, and the labor seems to have been largely expended in this direction, and towards elaborating gaudy designs, very few attempts having been made as yet towards attaining that simplicity and elegance in design which the principles of good taste clearly dictate. Lithographed labels are sought for principally because the designs more closely approach those of engraved labels; but engraved labels cannot be used generally, because of their costliness.

Bronze-, green-, and red-bordered labels are seen in label catalogues

in great profusion, and in one a sentimental moonlight Venetian scene in colors is conspicuously displayed on one end of a castor oil label! One leading principle will probably be of service in this connection, and that is to avoid loud, striking designs of all kinds: the appetite of

FIG. 503.

Fancy, obscure, and pretentious label.

all, patient, pharmacist, and physician, soon becomes satiated with such, and the notion that they influence business in any good way is soon proved to be a delusion. The almost universal tendency of printers in selecting type for a label is to choose the largest that can possibly be used to get the subject-matter inside the border: the effect is exactly

FIG. 504.

SWEET SPIRIT OF NITRE.

For a child six months to a year old . .	10 to 12 drops.
Five years old	25 drops.
Ten years old	40 drops.
Adults	1 teaspoonful.

Take in sweetened water, and repeat every 3 or 4 hours.

PROCTER & PARRISH,

145 N. TENTH STREET, PHILADELPHIA.

Plain, old-fashioned, and inexpensive label.

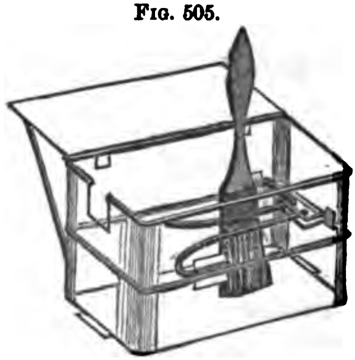
opposite to that which is usually desired, for it adds nothing to the neatness of the label, certainly sacrifices distinctness, and the general impression conveyed is that of a confused mass of letters, which is more difficult to decipher than letters of the proper size and breadth of face appropriately set off by *sufficient blank space.* Plain black letters on a white ground are preferable. (See Figs. 503 and 504.)

Neatness, distinctness, and simplicity are cardinal principles in de-

signing labels, and the reputation of many establishments is frequently judged from the character of the outward signs of neatness and care. For this reason particular attention should be paid to prescription labels, not only to have the printed address plain, clear, and neat, but to have the handwriting to correspond. In these important particulars patients are exceedingly apt to form an estimate of the qualifications of the compounder of a prescription from the style of his penmanship, reasoning that if he is careful, clean, and neat in the *one particular* of which they are competent to judge,—*i.e.*, the handwriting on the label,—the compounder must exercise similar qualifications in the more vital operations involved in compounding and dispensing, for upon the technicalities of the latter they cannot hope to pass judgment.

Labelling Poisonous Substances.—Whenever a poison is dispensed to customers upon an order, without being prescribed by a physician, the word poison should be distinctly written upon the label: if solid, and wrapped in paper, it should have two wrappers upon it, and both should be labelled poison. In the case of prescriptions, the word poison *should not appear upon the package or bottle unless the physician has so directed.* A careful pharmacist will be sorely tempted to prevent possible accident by pasting a poison label upon the package, but he is relieved entirely of responsibility if the dose is not excessive and if the physician has not directed it, because there is usually a special reason *for omitting it* from the label,—namely, that of avoiding the possibility of frightening the patient and thus defeating the object of the prescription. When a poison label is to be used upon a bottle it should be pasted on above the prescription label, so that it will be more likely to be seen, without possibility of failure through being covered by the hand holding the bottle.

FIG. 505.



Sabin's mucilage-can.

Pasting Labels.—Few of the minor operations in dispensing are more important than this. Although frequently the subject of remark and criticism, there have been comparatively few real improvements in this direction. Sabin's mucilage-can is a convenience which many appreciate, particularly the advantages of the simple device for avoiding an excess of paste on the brush. The label is laid upon the back of the lid of the can, which is thrown back for the purpose, and held in position. The can should be closed when not in use. (See Fig. 505.) The best paste for prescription use is made from flour by the following process·

FLOUR PASTE.

Flour (wheat)	4 oz. (troy).
Water	16 fl. oz.
Nitric Acid	1 fl. dr.
Oil of Cloves	5 minims.
Boric Acid	10 grains.

Thoroughly mix the flour, boric acid, and water, and strain the mixture through a sieve; add the nitric acid; apply heat, with constant stirring, until the mixture has thickened; when nearly cold, add the oil; strain it through coarse muslin if not perfectly smooth. This paste keeps well, and is much superior to tragacanth mucilage and ordinary paste. When it is required for pasting labels on tinned surfaces, the addition of 10 per cent. of glycerin will prevent the labels from falling off after drying.

In applying a label which has been pasted, to a box, bottle, or can, care should be used not to touch with the fingers the portion of the label which has been recently written upon, even if it has the appearance of being dry. A piece of blotting-pad or filtering-paper, slightly larger than the label, should be laid upon it, and pressed gently, smoothly, and evenly, so that the excess of paste which has exuded upon the edges may be absorbed. If a label has had too much paste applied, and the excess has not been pressed out as described, it will have a wrinkled appearance. Labels should be neatly trimmed, showing a very slight but uniform margin around the border. They should be pasted upon bottles just above the centre, and never over the seams or mould-marks, but halfway between them.

FIG. 506.

Label-dampener.

Gummed Labels, or labels printed on paper coated with a solution of dextrin, or gum, on one side, are used largely in some sections of the country. They appear to answer a good purpose in some localities where there is a dry atmosphere, but when used on the seaboard or in damp atmospheres considerable loss is often experienced from their sticking together. Fig. 506 shows a label-dampener which was obtained from the Pictorial Printing Company of Chicago. It is a brass cylinder, having a tightly-fitting screw-cap, with a slightly perforated bottom covered with felt. The cylinder is filled with water, sufficient of which oozes through the perforation to keep the felt moist.

Arranging and Preserving Labels.—A method of classifying labels must be adopted by each pharmacist which will be suited to his own requirements. The general rule is to arrange them in label drawers in the most convenient place in the store. The label drawers are preferably shallow, made of wood, and having compartments to receive the labels. Considerable space may be saved by having the compartments made of tinned iron instead of wood. The bottom of the drawer may be lined with cotton-flannel, to prevent the labels from slipping underneath the tin divisions and becoming mixed by the continuous opening and closing of the drawer. It will be found convenient to separate the plain labels required constantly for articles in daily request from those of larger size or special design; and the former may be classified into labels for solids and labels for liquids. These may be arranged alphabetically in each drawer, so that they shall be quickly found. *A regular system should be adopted and rigidly carried out; and when a place has been once fixed for a label, it should never be changed,* as few trifles give more annoyance than inability to find a label in a pressing rush of business.

The upright label cabinets which have been contrived answer an excellent purpose where upright space can be spared.

QUESTIONS ON CHAPTERS LXIII. AND LXIV.

DISPENSING AND PRESCRIPTIONS.

In the arrangement of the drug store, how should solid substances which are subject to injury from exposure to light be kept?
How should odorous drugs, such as valerian, be kept?
How should volatile oils be kept?
How should corrosive or deliquescent salts be kept?
How should poisons, alkaloids, and powerful substances be kept?
What is the definition of the word "prescription"?
From what Latin word is it derived?
What are the advantages of using Latin in writing prescriptions?
What is meant by "the superscription" of a prescription, and of what does it consist?
What is used in French prescriptions?
Is it desirable to have the name of the patient written on the prescription? Why?
What is meant by the inscription?
Of what parts should a model compound prescription be composed?
Give the meanings of these various parts.
How does the physician usually ascertain the quantities desired of the various ingredients in writing a prescription?
Give the various characters used in Latin prescriptions, and write out their names in full in Latin.
What sort of numerals are used, and what position do they occupy in reference to the ingredients?
What is meant by "the subscription" to a prescription?
What is meant by "the signa" to a prescription?
What is the use of having the name of the physician attached to a prescription?
How should unusual doses in prescriptions be marked or designated?
What would be understood by the following abbreviations occurring in prescriptions?—Acid. hydroc.; aconit.; ammon.; aq. chlor.; calc. chlor.; chlor.; emp. lyt.; ext. col.; hyd. chlor.; hydr.; mist. ammon.; potass. hyd.; sod. hypo.; sod. sulph.; sulph.; zinc. phos.

Translate the following prescriptions, and also the accompanying directions:

Recipe Liquoris Ammonii Acetatis, drachmas tres cum semisse;
Vini Antimonii, drachmas duas;
Tincturæ Cardamomi Compositæ, drachmas tres;
Aquæ Menthæ Piperitæ, uncias quatuor.
Fiat mistura, cujus unciæ duæ omni horæ quadrante calefactæ sumendæ, durante frigore.

Recipe Rosæ Gallicæ, unciam dimidiam;
Aquæ ferventis, uncias octo.
Stent per horam; colaturæ adde Succi Limonum, Sacchari, ana, quantum sufficit, ad gratam acerbitatem dulcedinemque.

Recipe Extracti Colocynthidis Compositi, drachmam unam;
Pulveris Scammonii, scrupulum unum;
Pulveris Cambogiæ, grana quinque.
Misce.—Fiant pilulæ viginti, quarum duæ deglutiantur horâ decubitûs; diluculò, ut infra.
Recipe Infusi Sennæ, unciam unam.

Recipe Potassii et Sodii Tartratis, sesquidrachmam;
Cretæ Præparatæ, semidrachmam.
Misce.—Fiat pulvis in jusculo tenuissimo sumendus.

Recipe Ammonii Carbonatis, grana sex;
Syrupi Aurantii, drachmas duas;
Aquæ, drachmas decem.

Misce.—Fiat haustus, cui, tempore capiendi, adde Succi Limonis recentis cochleare medium unum, et in effervescentiâ sumatur.

Recipe Tincturæ Opii, semidrachmam;
Spiritûs Chloroformi, drachmam;
Misturæ Cretæ,
Aquæ Menthæ Piperitæ, ana, uncias tres.

Misce.—Fiat mistura, cujus sumantur cochlearia duo magna post unamquamque sedem mollem, phialâ prius concussâ.

Recipe Misturæ Ammoniaci, uncias sex;
Tincturæ Opii, drachmam.

Misce.—Capiat cochlearia duo magna statim; iterentur post horam, si tussis accreverit.

Recipe Extracti Belladonnæ Fluidi, drachmam cum semisse;
Lini Farinæ, uncias duodecim;
Aquæ bullientis, quantum sufficit ut fiat cataplasma admovendum calidè loco adfecto.

Recipe Cetrariæ, unciam;
Aquæ frigidæ, octarium.

Coque ad uncias duodenas; stet ut geletur, et utatur æger gelatinâ ad libitum.

℞ Magnes. Carb., ʒi;
Pulv. Rhei, gr. xv;
Aq. Anisi, f℥iss.

M.—Fiat julep.[1] cujus unum cochl.[2] minim.[3] infant.[4] lacten.[5] detur, secundis horis: phiala agitata.

℞ Sp. Ammon. Arom., fʒi;
Tinct. Asafœt., f℥ss;
Syrupi, fʒiij;
Aq. Cinnam., f℥i.

M.—Exhibe cochl. parv. ter quaterve de die, vel sæpius, urgente convuls.[6] vel spasm.[7]

℞ Tinct. Hyoscyami, fʒiss;
Pot. Acet., ʒiv;
Syr., fʒij;
Aq. Menth. Vir., ad f℥vi.

Ft. mist. cujus sumant.[8] cochl.[9] ij vel iij minim.[10] bis terve in die, vel ut opus sit.

℞ Tinct. Opii, fʒss;
Mist. Cret., f℥iij.

M.—Cap. cochl. ij magn.[11] omni quadrante horæ, donec leniat.[12] dolor.

℞ Pulv. Ipecac., ʒiss;
Pot. Bitart., ʒi;
Aq. fervent., f℥iiiss.
Macera per horam integr.[13] dein cola et adjice syr., f℥ss.

M.—Detur ℥ss vel cochl.[14] ampl.[15] omni semihorâ, donec vomit.[16] proritav.[17]

℞ Plumbi Acet., gr. iv;
Syrup., fʒij;
Aq. Menth., f℥ij.

M.—Cap. cochl. ampl.[18] mane quotidie; repetat.[19] dosis ad iij vices, et deinde cap.[20] æger haust.[21] aliq.[22] purgant.[23]

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[1] Julepum. [2] Cochleare. [3] Minimum. [4] Infantulo. [5] Lactenti. [6] Convulsione. [7] Spasmo. [8] Sumantur. [9] Cochlearia. [10] Minima. [11] Magna. [12] Leniatur. [13] Integram. [14] Cochleare. [15] Amplum. [16] Vomitum. [17] Proritaverit. [18] Amplum. [19] Repetatur. [20] Capiat. [21] Haustum. [22] Aliquem. [23] Purgantem.

℞ Mist. Ammon.,[1] f℥vi;
Cap. æger cochl. mag. bis in die ex poculo jusc.[2] bov.[3]

℞ Morph. Acet., gr. ¼;
P. Colch.,[4] gr. iij.
Ft. pil. 4tis[5] horis s.[6]
Mitte vi fol.[7] arg.[8] inv.[9]

℞ Sodii Bicarb., ʒiij;
Ammon. Bicarb., ℈ij;
Pot. Nit., ʒss;
Syr. Aurant., f℥ss;
Ac. Hydrocyan. dil., gtt. xx;
Aquæ, ad ℥viij.
M.—Capiat ℥iss t. in d. cum pulv. i seq.[10] m.[11] stat.[12] effervesce.[13]

℞ Ac. Tart., ℈i;
Mitte chart. vi.

℞ Ol. Morrhuæ, f℥viij.
Sum.[14] coch. min. (ad. ampl.[15] augend.[16]) bis die c.[17] mist. sequent.[18] coch. ampl.[19]

℞ Acid. Phosph. dil., f℥ss;
Tinct. Nuc. Vom., fʒij;
Tinct. Calumb.,
Syr. Zingib., āā f℥i;
Aq. Cinnam., q. s. ut ft. f℥viij.
M.—Ft. mist.

What are meant by gravimetric prescriptions?
What are the supposed advantages of this method?
What are meant by volumetric prescriptions?
What are the advantages of this method?
What relation does the cubic centimetre bear to the gramme?
Write prescriptions according to each of these methods.

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[1] Ammoniaci. [2] Jusculi. [3] Bovini. [4] Colchici. [5] Quartis. [6] Sumenda. [7] Folio. [8] Argenteo. [9] Involve. [10] Sequenti. [11] Mane. [12] Statu. [13] Effervescentiæ. [14] Sumatur. [15] Amplum. [16] Augendum. [17] Cum. [18] Sequentis. [19] Amplo.

CHAPTER LXV.

EXTEMPORANEOUS LIQUID PREPARATIONS.

Solutions, Mixtures, and Emulsions.

OFFICIAL liquid preparations have been treated of in Part II. They will therefore not be considered in the present chapter, which will be confined to the extemporaneous compounding of liquids. It will soon be realized by the student that this branch of practical pharmacy involves some of the most intricate questions of physical and chemical science: the knowledge which he has heretofore acquired of the solubilities of solids in various solvents, simple and compound, the solubility of liquids with one another, chemical decompositions, reactions between acid and alkaline salts, precipitation through single and double decomposition, etc., will often be of great service. This, coupled with practical experience, together with the exercise of original ingenuity, must be depended upon to meet the perplexing questions which continually arise. See autograph and fac-simile prescriptions, pages 1125 to 1155.

Extemporaneous liquid preparations may be classified as follows: 1. *Solutions*, by which are meant liquid preparations containing dissolved solid substances. 2. *Mixtures*, liquids in which the solution is but partial, insoluble particles being held in suspension. 3. *Emulsions*, preparations containing oily or resinous substances mixed with water so as to form homogeneous liquids. These will be considered *seriatim*.

1. **Solutions.**—The methods generally employed in making solutions have been treated of in the preceding chapters, and it must be presumed that the reader is familiar with them. Most of the difficulties encountered in effecting solutions required by prescriptions arise from the want of knowledge on the part of prescribers of the solubilities and of the physical and chemical characteristics of the medicinal agents which they order to be compounded. It is necessary, therefore, for the pharmacist to be well grounded in these particulars, whilst therapeutical knowledge must not be neglected either, lest the addition of some apparently inert substance, intended to improve the preparation pharmaceutically, be injurious therapeutically. The subject of incompatibility must be thoroughly comprehended.

INCOMPATIBILITY.

Incompatibility may be defined as a term used to express the effects produced in pharmaceutical mixtures by chemical decomposition, physical dissociation, or therapeutical opposition. There are, therefore,

three kinds of incompatibility,—Chemical, Physical, and Therapeutical.

Chemical Incompatibility invariably results in the decomposition of one or more of the ingredients entering into the prescription: it must not be assumed, however, that this decomposition is always unintentional on the part of the prescriber. The most frequently occurring forms of chemical incompatibility are indicated as follows:

1. Through the precipitation of an insoluble salt, produced by the addition of one solution or salt to another.

2. By the decomposition of a salt (in solution) containing a base united with a weak or volatile acid, by the addition of a strong acid.

3. Through the decomposition of a salt (in solution) containing an acid united with a weak or volatile base by the addition of a strong alkali.

4. By the precipitation of alkaloidal salts by the addition to their solutions of alkalies, alkaline salts, or salts which produce insoluble compounds.

5. By the unsightly discoloration or precipitation due to the formation of inky compounds, produced by bringing astringent solutions containing tannin or similar substances in contact with ferric salts.

6. By the decomposition of a solid substance without precipitation, because of the formation of products which are soluble in the liquid.

1. *Through the precipitation of an insoluble salt, produced by the addition of one solution or salt to another.*

Incompatibility in this case may be either Intentional or Unintentional.

Chemical incompatibility is a condition which is very likely to be misunderstood. It does not follow that because precipitation ensues when two transparent liquids are mixed, or in any other way, the decomposition was not intended. Cases of this kind demand good judgment on the part of the pharmacist: this may probably be best illustrated by the following examples:

℞ Plumbi Acetat., ℥ss;
Zinci Sulphat., gr. xv;
Aq. Rosæ, f℥iv. M.
Sig.—Use as an injection.

The novice would be very apt to imagine that the doctor had made a mistake in writing this, or was sadly deficient in chemical knowledge not to be aware that decomposition would take place here, that the insoluble lead sulphate would be formed, and that the astringency of the salts would be destroyed; but the experienced pharmacist would know at once that he must not filter this prescription, but dispense it with a "shake" label, because the precipitated lead sulphate is the really important agent. A very different case is presented in the following, which may be cited as an illustration of chemical incompatibility arising from lack of knowledge of the solubilities of the salts on the part of the prescriber:

℞ Quininæ Sulph., gr. x;
Potassii Acet., gr. xx;
Acid. Sulph. Dil., gtt. v;
Aquæ Cinnamomi, f℥i.
Sig.—A tablespoonful every three hours.

The usual procedure would be either to dissolve the quinine salt in the cinnamon water with the aid of the diluted sulphuric acid, and then add the potassium acetate, or to make separate solutions of each, and then mix them. In either case the result would be the formation of a voluminous precipitate of quinine acetate, preventing the possibility of carrying out the directions to the patient of taking a tablespoonful, because it could not be poured. Although this precipitate could be dissolved in acetic acid or alcohol, so much would be required of either that the character of the prescription would be materially altered: hence quinine sulphate and potassium acetate should never be prescribed together in solution. Many other illustrations of chemical incompatibility could be given, but want of space will prevent giving more than one example of each class.

2. *By the decomposition of a salt (in solution) containing a base united with a weak or volatile acid, by the addition of a strong acid.*

It would appear at first sight that cases in which this condition is present must be rare: the intentional decomposition of an alkaline carbonate by citric, tartaric, or acetic acid is very common, however, and most agreeable and successful febrifuge solutions are made in this way. Unlooked-for decomposition most frequently arises from the use of the vinegars or syrups containing acetic acid in the same prescription with alkaline carbonates, the presence of the acid being generally lost sight of by the prescriber. The following is a good example:

℞ Ammon. Carb., gr. xx;
Ammon. Chlor., gr. xxx;
Syr. Allii, f℥i;
Aquæ, q. s. ft. f℥ij.
Sig.—A half-teaspoonful as required.

Explosions have occurred in compounding this prescription, when the syrup of garlic has been placed in the bottle and the solutions of the ammonium salts added, and the cork inserted securely. The only way to compound it safely would be to mix the solution of the ammonium salts with the syrup of garlic in a mortar, and to allow all the carbonic acid gas, produced by the action of the acetic acid in the syrup on the ammonium carbonate, to escape, assisting the evolution by stirring with the pestle.

3. *Through the decomposition of a salt (in solution) containing an acid united with a weak or volatile base by the addition of a strong alkali.*

Instances are less frequent where this condition exists, although it is sometimes seen; as when ammonia-alum is directed to be mixed with potassium hydrate to form an astringent caustic, gaseous ammonia being liberated through decomposition.

4. *By the precipitation of alkaloidal salts by the addition to their solutions of alkalies, alkaline salts, or salts which produce insoluble compounds.*

This form of incompatibility is one of the most dangerous that are likely to be encountered. The alkaloids are very largely used, and are nearly all violent poisons; they are usually combined with acids in order to present them in forms which are soluble: strychnine sulphate, for instance, is soluble in about 10 parts of water, whilst strychnine requires 6700 parts of water to dissolve it; the combination of an alkali

or an alkaline salt with the strychnine sulphate would throw the strychnine out of solution.

℞ Strychninæ Sulph., gr. i;
Potassii Bromid., ʒvij;
Aquæ, q. s. ft. f℥viij.

An inexperienced pharmacist would unhesitatingly proceed to compound the above prescription. A transparent solution would be obtained without difficulty, which would be dispensed without the slightest misgiving, but which in all probability would produce disastrous results. This solution deposits in a few hours the greater part of the strychnine salt as an insoluble bromide, which quickly subsides in transparent crystals. A lady in England lost her life by taking a similar mixture. She carefully refrained from shaking the bottle, the strychnine precipitate formed in the bottom, and in taking the last dose she swallowed nearly all of it. A similar case of dangerous chemical incompatibility occurred in the author's personal experience, the following having been prescribed by a physician who had overlooked the fact that the salts of most alkaloids are decomposed by alkaline solutions, and the alkaloids, being less soluble than the salts, are precipitated:

℞ Morph. Sulph., gr. ij;
Potass. Bicarb., gr. xc;
Aquæ, q. s. ft. f℥ij.
Sig.—Take a teaspoonful mixed with half a teaspoonful of lemon-juice.

The morphine was precipitated by the alkaline carbonate; and if the bottle had not been shaken before pouring out the teaspoonful which was mixed with the lemon-juice, the last dose would have contained nearly all of the morphine.

5. *By the unsightly discoloration or precipitation due to the formation of inky compounds, produced by bringing astringent solutions containing tannin or similar substances in contact with ferric salts.*

The frequent occurrence of incompatibility of this kind is accounted for by the extensive employment of liquids containing tannin with iron salts. Preparations of cinchona bark with iron are probably the best illustrations of this class:

℞ Ferri Sulph., gr. xx;
Tinct. Cinch. Comp., f℥ij.
Sig.—A teaspoonful before meals.

6. *By the decomposition of a solid substance without precipitation, because of the formation of products which are soluble in the liquid.*

Prescriptions containing syrup of lactucarium and alkaline solutions often lose their sedative effect through the action of the alkali. Syrup of chloral when mixed with alkalies is injured through the elimination and subsequent evaporation of chloroform. The importance of a knowledge of the physical properties of chemical substances is realized very frequently in cases of this class.

Physical Incompatibility may be defined as the condition arising from the admixture of pharmaceutical preparations which results

in the *physical* dissociation of one or more constituents. It differs from chemical incompatibility by the absence of *chemical* action, and is generally produced by adding one liquid or substance to another, which results in the precipitation of solid matter or the separation of a portion of liquid: hence the solubilities of substances in liquids and the relative solubilities of various liquids with one another determine to a very great extent the condition of physical incompatibility. The illustrations of this condition are so numerous that it would be idle to select more than a few which are prominent or typical. Two classes may be distinguished, and it is often important to recognize quickly the difference between them: 1, Physical incompatibility resulting in the separation of *active or important* constituents, and, 2, Physical incompatibility resulting in the separation of *inert* constituents.

1. *Physical incompatibility resulting in the separation of active or important constituents.*

This condition is one which usually demands skilful treatment. It is seen most frequently in the precipitation produced by mixing resinous tinctures or oily liquids with aqueous liquids, or alcoholic solutions containing volatile oils, chloroform, ether, or similar substances with aqueous liquids, or by the addition of acids to solutions containing quinine with a preparation of liquorice. The addition of acacia, so as to form an emulsion with the resinous tincture and the aqueous liquid, is necessary in the first case, and will be considered under the head of emulsions. Aqueous liquids mixed with alcoholic solutions containing volatile oils can usually be made transparent by filtering them through an absorbent powder like magnesium carbonate, as in the case of the medicated waters or elixirs. A frequent source of doubt arises in the case of prescriptions like the following:

For Willie.
℞ Quininæ Sulph., gr. xxx;
Acid. Sulph. Dil., q. s.;
Ext. Glycyrrh. Fld., f℥ij;
Syrupi, f℥iv.
Sig.—Give a teaspoonful three times a day.

The indications are clear that this is a quinine mixture intended for a child, and that the prescriber has directed the fluid extract of liquorice with the view of making it more palatable. The habit of ordering acid in connection with quinine clings to him still, and in all probability he is not aware of the fact that the sweet principle of liquorice, glycyrrhizin, is precipitated by the acid, so that the object of using the preparation of liquorice is entirely defeated by the addition of the acid. Solutions of quinine should be administered either as transparent liquids when the presence of acid is relied upon to effect the solution, or as mixtures with syrups or with thick liquids containing liquorice; in the latter case the object is to *prevent* solution as much as possible, and frequently a trace of solution of potassa is added with this end in view,—the principle being, that the smaller the quantity of *dissolved* quinine present in the liquid the less bitter will be the taste. The mixture should be thoroughly shaken before administration.

2. *Physical incompatibility resulting in the separation of inert constituents.*

This condition is most frequently seen when fluid extracts are diluted with liquids which differ in composition from those used in making the fluid extract, such as alcohol, diluted alcohol, syrup, aqueous liquids, etc.: the gummy, albuminous, resinous, or mucilaginous constituents are often thrown out of solution. After proving that the precipitate is inert, the remedy is simple in such cases, and filtration is all that is necessary.

Therapeutical Incompatibility may be defined as the condition arising from the combination of remedies which are mutually opposed to one another in therapeutical effect. This form of incompatibility does not require the aid of the pharmacist: it results from an injudicious combination of remedial agents, and the correction of the fault lies solely within the province of the physician.

COMPOUNDING EXTEMPORANEOUS SOLUTIONS.

Use of Heat.—As a general rule, it is not advantageous to aid the solution of a solid by heating it in contact with the solvent, except where the quantity of liquid is known to be in excess of what is required to form a solution; and such a liquid should never be dispensed until it has become cool. If the solid be crystalline, the excess will surely separate in crystals when the liquid cools, and the patient will become uneasy and suspicious, fearing lest some mistake has occurred. It frequently happens that more of a solid has been prescribed than can be dissolved in the amount of liquid desired; indeed, it is entirely too much to expect that every practitioner should carry in his mind the exact solubilities of all the solids that he prescribes in the respective liquids in which he may wish to dissolve them. This gives the pharmacist another opportunity to use his knowledge and judgment, and the problem

When to Filter is oftentimes perplexing, although one simple rule should govern the practice: *A solution may be filtered and dispensed as a transparent liquid when the removal of the excess does not interfere with the medicinal properties and action of the medicine, nor conflict with the obvious intention of the prescriber.*

Solutions of potassium chlorate, to be used as gargles, are good illustrations:

℞ Potassii Chlorat., ℥iv;
Aquæ Acidi Carbolici, f℥ij;
Infus. Salviæ, f℥iv.
Sig.—Use as a gargle.

The quantity of the salt here is about twice too much, and, as the solution is intended as a gargle to inflamed surfaces, the undissolved particles of chlorate of potassium would probably act as irritants. They can be of no use in the solution, and in this case filtration is perfectly admissible. The following prescription should not be filtered, and the pharmacist is compelled to rely solely upon his judgment and knowledge of the therapeutical action and properties of the ingredients:

℞ Magnesiæ Pond., ℥iss;
Massæ Hydrarg., ℥ss;
Sacch. Alb., ℥i;
Spt. Ammon. Arom., ℥ij;
Aq. Menth. Pip., f℥ij;
Aq. Calcis, f℥iij.
Sig.—A tablespoonful every two hours.

The reasoning here would be direct and simple. The prescriber evidently intends this to be an alkaline cholagogue mixture, although the directions to "shake the bottle" have been omitted. Heavy magnesia and blue mass are both practically insoluble in the liquids, and if they are filtered or strained out the mixture is deprived of its most important constituents. It should be dispensed as a mixture, and a "shake" label used.

Aids in Effecting Solution.—The use of solvents which are not directed in the prescription, for the purpose of effecting the complete solution of the ingredients, requires probably the greatest amount of good judgment. The practice is one which is liable to great abuse, and a strict rule should be enforced that no addition is admissible under any circumstances except one which is absolutely demanded by necessity and which will in no wise impair the therapeutical effect. The prescriber should have reason to place implicit reliance upon the compounder and feel satisfied that he has received exactly what was ordered. The following is a good illustration of a case requiring an addition; a physician prescribed it as an application for dry, excoriated nipples:

℞ Acidi Carbolici, gr. xl;
Aquæ, f℥ss.
Sig.—Solution Carbolic Acid. Use with a camel's-hair brush.
DR. W.

Commercial carbolic acid is not soluble in water in the proportions named, only about 1 part dissolving in 20 parts of water. The pharmacist dispensed the prescription just as it was written, with the excess of carbolic acid in the bottom of the bottle. The patient inserted the camel's-hair brush and permitted it to remain in the bottle, so that it reached the bottom and became saturated with the undissolved carbolic acid. The application produced severe pain and alleged serious injury, and became the ground for a civil suit for damages against the pharmacist, brought by the patient. If the pharmacist had added a small quantity of glycerin, all difficulty would have been avoided, and he could then have dispensed a perfect solution. It is hardly necessary to say that the physician should not have omitted prescribing the glycerin; but, as he failed to do so, it was the duty of a careful pharmacist to inform him of the facts, or, failing to find him, to supply the deficiency and subsequently notify him of the addition.

The Order to be followed in Mixing the Ingredients is frequently very important, and many prescriptions which at first sight appear to contain incompatibles will be easily compounded by observing the proper order in mixing. As has been shown, precipitation frequently takes place when one liquid or solution is added to another, and this annoyance is much more apt to occur when concentrated solutions are

brought together: hence the dilution of the solution is recommended as one method of avoiding precipitation. An illustration is afforded in the following:

℞ Liq. Ammon. Acet., f℥iv;
Acidi Acetici, f℥i;
Tinct. Ferri Chloridi, f℥ss;
Glycerini, f℥ss;
Mucilaginis Acaciæ, ad f℥viij.
Sig.—A teaspoonful every three hours.

If the tincture of ferric chloride be mixed with the acetic acid and glycerin, and then added to the solution of ammonium acetate, and this solution mixed with the mucilage of acacia, no gelatinization will occur; but if the tincture of ferric chloride be added to the mucilage, undiluted, a gelatinous precipitate will form, and, although the subsequent addition of the other ingredients will, in time, dissolve the precipitate, this time could be saved by following the proper order. Then, again, in the following:

℞ Hydrarg. Chlor. Corros., gr. iij;
Mucilag. Acaciæ, f℥i;
Aquæ,
Aquæ Calcis, āā f℥ij:

If the corrosive mercuric chloride be dissolved in the water and then mixed with the mucilage, and the lime water added subsequently, no precipitation will occur; but if the corrosive mercuric chloride be added to the lime water and then to the other ingredients, the yellowish-red mercuric oxide will be formed, which is insoluble in the liquid.

The following rule should be insisted upon: *Whenever a difference in the appearance of a liquid is produced by a variation in the order of mixing, a memorandum noting the order should be made upon the prescription at the time it is compounded, so that in case of renewal the same order may be followed.*

MIXTURES.

Mixtures, properly speaking, are aqueous preparations intended for internal administration, containing some insoluble substances, with frequently viscid or sweet liquids to aid in suspending them. The official mixtures have been already noticed (see page 316). The term mixture, however, is indiscriminately applied in extemporaneous pharmacy and in prescriptions to aqueous solutions of all kinds: for instance, solution of potassium citrate is frequently termed fever mixture, although it is a perfectly transparent solution.

Most of the remarks made upon solutions will be found to apply to the preparation of mixtures. Especial care must be taken to obtain the precipitate in as light a form as possible, so as to avoid impaction and partial solidification in the bottle: this may be best done by avoiding the mixing of concentrated solutions.

EMULSIONS.

Emulsions are aqueous liquid preparations in which oily or resinous liquids are suspended by the agency of gummy or viscid substances. They may be conveniently divided into two classes: 1. Natural emul-

sions. 2. Manufactured emulsions. They are opaque liquids, generally of a thick consistence. (See Emulsa, page 315.)

1. **Natural Emulsions** are those which are found in nature, ready formed, as the milky juices of plants, the milk of animals, yolk of egg, etc.

2. **Manufactured Emulsions** are those which are made artificially by various processes: the art of producing them is termed *emulsification.*

Manufactured emulsions are usually made from two classes of substances: 1. Those which contain an oily or a resinous compound associated *naturally* with either gum or some other emulsifying agent. 2. Oils, fatty and resinous bodies containing no emulsifying substance.

Gum-resin emulsions and seed emulsions are included in the first class. These are usually made by simple trituration in contact with water.

Gum-resin emulsions are made by reducing to a coarse powder, selected pieces of the gum-resin in a mortar, triturating with a small quantity of water so as to form a smooth, uniform paste, and then adding the remainder of the water, finally straining the mixture through a cloth strainer or a plug of absorbent cotton contained in a funnel. (See Emulsum Asafœtidæ, page 316.) Powdered gum-resin should never be used for making emulsions, because of the loss or deterioration of the volatile constituents which always takes place when the substance is dried so that it may be powdered.

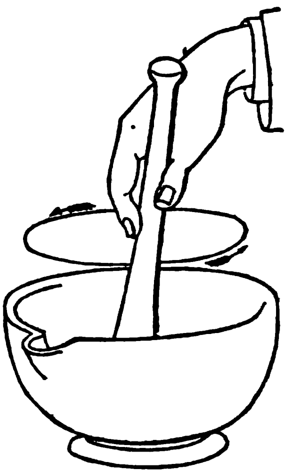
Seed emulsions are so termed because they are made by rubbing seeds or the kernels of fruits which contain fixed oils with water, the emulsifying agent being a gummy or albuminous substance found naturally in the seed or kernel associated with the oil. Emulsions of almond, castor-oil bean, croton-oil bean, etc., are examples of this kind. (See Emulsum Amygdalæ, page 316.)

The Theory of Emulsification is based upon a study of the best type of a natural emulsion,—namely, milk. This liquid is found, on examination, to consist of innumerable globules of a fatty substance (butter) enveloped in a thin membrane of viscid matter (casein) suspended in water. The object sought by the pharmacist in making emulsions is first to thoroughly divide the oily or resinous liquid into minute globules, and then to surround each globule with an adhesive envelope (mucilage of acacia, yolk of egg, etc.). The globules, when completely enveloped, are suspended in water; and if the emulsion is properly made, there will be no tendency on the part of the oily or resinous liquid to recombine. Several methods are employed in making emulsions, the most important of which, however, may be grouped under *two* typical methods, named from the geographical locations where they are used most frequently: 1. The English method. 2. The Continental method. Both are equally useful, and should be employed according to circumstances.

1. **The English Method.**—In this mode of making emulsions the emulsifying agent, consisting of mucilage, yolk of egg, etc., is first placed in a dry mortar, and small quantities of the oil and water are gradually and alternately added at intervals. The pestle is rapidly and

lightly rotated in the direction of the arrows (see Fig. 507), with the effect of dashing the oil into globules, which are at once enveloped by the viscid emulsifying agent. If the oil or water is added too rapidly at the beginning, or the mucilage has not been thick enough, the accident of "*cracking*" the emulsion occurs. This may be known by the "pearly" appearance assumed by the mixture, and on close examination the globules of unenveloped oil may be seen floating about. If each stage of the process is successful, the emulsion presents, upon thorough mixing after each addition, a smooth, opaque, glistening appearance like cream. Success depends largely upon the care exercised in forming the nucleus at the beginning; and this, therefore, should not be too hastily made. When an emulsion is "cracked," it need not be thrown away. It may be restored by placing an additional quantity of mucilage in the mortar and gradually adding the "cracked" emulsion to it, triturating after each addition, when finally the satisfaction of seeing the uncombined globules disappear will generally be experienced.

FIG. 507.



Emulsion mortar and pestle.

The English method of making emulsions is the best to use in general prescription practice, where the proportions of gum, oily, or resinous liquids and water must necessarily vary. A typical formula is appended:

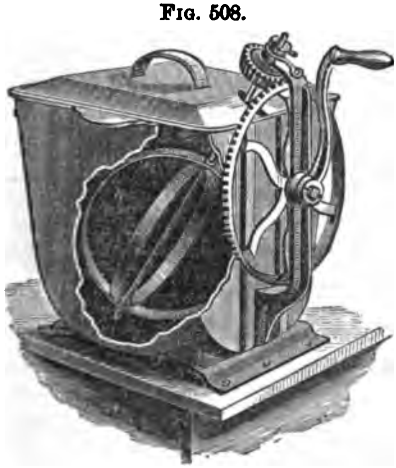
℞ Olei Morrhuæ, f℥ij;
Pulv. Acaciæ, ℥ss;
Aquæ, q. s. ft. f℥iv.

Place the acacia, which should not be finely powdered, but granulated, in a mortar with one fluidounce of water: this should be triturated until the mucilage is perfectly smooth and free from lumps. The oil should be added at first in quantities not greater than half a fluidrachm at a time, stirring rapidly with the pestle after each application, care being taken not to add a fresh portion of oil until the last has been thoroughly emulsified. When the liquid becomes too thick to be easily stirred, a fluidrachm of water should be mixed with it, and the gradual additions of oil continued until the whole quantity has been used: the larger quantity of water may be added rapidly after the nucleus is once properly formed, without risk.

2. **The Continental Method** has the great merit of never failing to produce a good emulsion if the proper proportions are used to form the nucleus, and if the directions are strictly followed. The most satisfactory proportions for the nucleus may be easily remembered: half as much water is taken as of oil, and half as much gum as of water; or it may be expressed as oil, 4; water, 2; gum, 1. The four parts of oil must be placed in a dry mortar and one part of finely-

powdered gum added to it, stirring with the pestle; when a uniform mixture is made, two parts of water are added, not gradually, but all at once, when, upon stirring, the emulsion is quickly made: an additional quantity of water may be added to this nucleus without risk. The explanation of making an emulsion by this method is, that the particles of gum, being insoluble in the oil and surrounded by it, are prevented from separating and dissolving in the water so as to form lumps; by stirring the mixture actively the water *gradually* dissolves the gum, the oil becomes incorporated at the same time, and a homogeneous mixture is produced, the quantities of oil, gum, and water being in exactly the right proportions to form an emulsion.

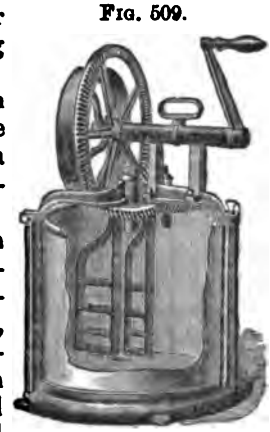
FIG. 508.



Hunter's emulsion apparatus.

In making large quantities of emulsions some mechanical device must be used to facilitate the rapid stirring and agitation necessary to form the nucleus. Fig. 508 represents Hunter's emulsion apparatus, or egg-beater. The principle of action is so well shown here that a description is unnecessary. If emulsions are to be made in still larger quantities, the sifter and mixer shown in Fig. 216 can be used by taking out the sieves and lining the receiving-box with tinned copper or otherwise making it water-proof, thus using only the mixer.

FIG. 509.



Sparrow mixer.

The Sparrow mixer is shown in Fig. 509: in this ingenious apparatus two stirrers are made to revolve by turning the gear-wheel, and a very rapid and effective motion may be imparted.

Casein Emulsions.—The use of casein as an emulsifier has been developed by Léger, a Parisian pharmacist. He recommends the preparation of *saccharated casein*, a fine white powder, which is used for emulsifying just as is powdered acacia. The advantages claimed for casein are that its emulsions are more readily retained by the stomach, and that greater stability and perfection are secured through its use.

Saccharated casein is prepared by heating one gallon of cow's milk to 104° F., adding two fluidounces of ammonia water, allowing the whole to stand a day, and separating the lower milky liquid from the oily liquid on top. The milky liquid (*lactoserum*) is treated with acetic acid until the casein is precipitated. After washing the precipitate thoroughly with water at 104° F. it is collected on a muslin strainer,

pressed, and dried; a weighed portion of the casein is dried and the percentage of moisture ascertained; the damp cake of casein is then triturated with three and a half ounces of powdered sugar and eight parts of sodium bicarbonate for every one hundred parts of casein (dry).

Prolonged trituration and the addition of more powdered sugar, until it amounts to nine parts in one hundred, result in the formation of a paste, which must now be dried by a gentle heat not above 86° F. to 90° F. After complete drying, it is powdered and sifted. To make a casein emulsion of a fixed oil fifteen parts of the oil are gradually incorporated with a mucilage previously made with fifteen parts of saccharated casein and five parts of water. When a perfect emulsion is formed the other ingredients are added.

Chondrus Emulsions.—Since acacia has advanced in price of late years various substitutes have appeared which have been tried as emulsifying agents, one of the most successful being the gelatinous substance obtained from chondrus or Irish moss. (See page 798.)

In the Formulary, Part VI., under the heads of Gelatinum Chondri, Mucilago Chondri, and Emulsio Olei Morrhuæ full information as to the methods of using it will be found. In this place it will only be necessary to say that a gummy substance in scales is produced by evaporating and desiccating a decoction of chondrus, and that a mucilage may be made from this Irish moss gelatin by heating eight grains of it in contact with one ounce of boiling water until it is completely dissolved. The mucilage, after being cooled, is then used for preparing emulsions exactly as is mucilage of acacia.

Quillaia Emulsions.—*Quillaia*, or *quillaja bark* (see page 948) contains the principle saponin, a glucoside which is capable of emulsifying oils. Senega contains an analogous principle. The property which both possess, of causing frothing in aqueous solutions, suggested the use of quillaia as an emulsifier. It has not come into extensive use, and care is necessary in employing it, as it is not without irritating properties. One of the essentials of a good emulsifier is that it should be inert. Quillaia has been adopted in the National Formulary. (See Emulsio Olei Morrhuæ, Part VI., which illustrates the method of using it.) Where an active medicine is to be made into an emulsion, and its properties are not antagonized by the quillaia, it may be judicious to employ it. Another disadvantage that it possesses is that a large quantity of tincture is required to be effective.

Compound Emulsions.—As a general rule, the addition of alcoholic liquids to emulsions destroys their homogeneity: when it is necessary to add them in compounding prescriptions, they should be diluted, if possible, with a portion of the water, and added after the emulsion is nearly finished. Alkaline solutions generally aid emulsification, by forming soaps with the resinous or oily liquids; volatile oils make better emulsions if they are first mixed with an equal volume of fixed oil.

THE DISPENSING OF LIQUIDS.

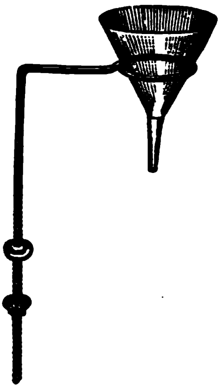
Every convenience should be adopted to facilitate quick and accurate dispensing. The sink should be close to the prescription counter. A good draining surface for graduates to rest upon is made by fastening

sheets of corrugated rubber (a piece of rubber matting) to the slightly-inclined shelves above the sink (see Fig. 125); and a brush for quickly cleaning graduates should be accessible (see Fig. 510). In addition to the

FIG. 510.

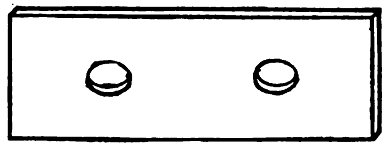
Graduate-brush.

FIG. 511.



Funnel-holder.

FIG. 512.



Funnel-board.

retort-stand already referred to, the very convenient little funnel-support figured in New Remedies a few years ago may find a place upon the prescription counter (see Fig. 511): the long screw permits the ring to be adjusted to any desired height. For larger filtering operations the funnel-board (Fig. 512) will prove useful.

Bottles.—The size and shape of the bottles used in dispensing liquids are largely matters of individual taste. The tendency at present is towards oval bottles for prescriptions, because they afford proportionally more space for the label than either round or square bottles: this is noticeable to a greater extent in the smaller sizes than in the larger ones. In addition to this, oval bottles are more convenient to carry in the pocket than those of any other shape. Fig. 513 shows an oval metric bottle.

FIG. 513.

Oval metric bottle.

FIG. 514.

Poison-bottle.

FIG. 515.

Poison-bottle.

Prescription-bottles are now frequently made of amber glass, to protect the contents from the effects of the actinic rays of light. For poisonous liquids, or for liquids intended for external application, blue bottles studded at regular intervals with pyramidal points are used: these are

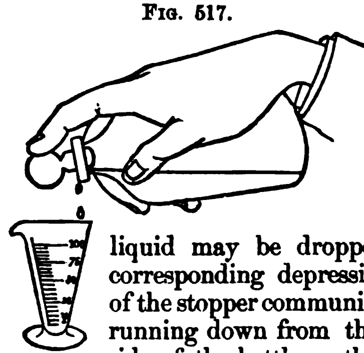
designed to attract attention through their peculiar color and shape, and thus prevent errors; the points render them easily distinguishable from ordinary bottles by the sense of touch, so that the patient can recognize a poisonous liquid in the dark. Fig. 514 and Fig. 515 show two sides of this bottle.

FIG. 516.

Pouring from shop-bottle.

In pouring liquids from the dispensing-bottles it is well to establish the habit of extracting the stopper with the left hand, holding it with the little finger; the graduate is held between the forefinger and thumb of the left hand, the bottle is grasped by the right hand with the label uppermost (see page 1102), and the liquid should be poured down the side of the graduate, to avoid splashing (see Fig. 516). Fig. 517 shows the method of dropping liquids from a dispensing-bottle: the stopper is loosened, prevented from dropping out by holding it with the finger, and the bottle inclined so that the rate of dropping may be controlled. Fig. 518 shows a very convenient bottle for dispensing liquids which are to be administered by drops: it is made in Germany. The glass stopper has a deep conical depression extending nearly half-way up the side, whilst the neck of the bottle is furnished with an aperture having a slightly projecting lip: when the stopper is turned so that the upper part of the depression is opposite the little aperture in the side, the liquid may be dropped very uniformly. A corresponding depression on the opposite side of the stopper communicates with a little channel running down from the lip upon the opposite side of the bottle, so that air is supplied during the dropping: by turning the stopper half-way around, both apertures in the neck of the bottle are closed.

FIG. 517.



Dropping from shop-bottle.

FIG. 518.

German dropping-bottle.

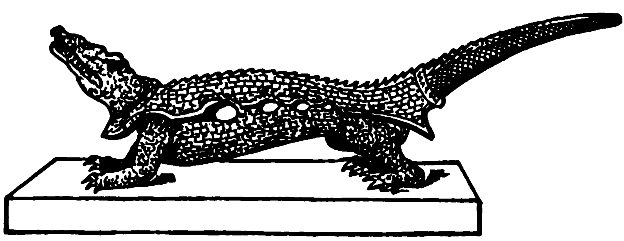
Corks are indispensable for stoppering bottles. They should be selected with great care. There is a wide difference in price between the best quality and the common grades, but it is true economy to use only the best. Short corks, which, when inserted tightly, so as to secure the contents from leakage, do not project above the lip sufficiently to furnish a good grasp for the fingers when extracting them, should never

be used for prescription-bottles. Brittle, hard, or dry corks, which break off when the attempt is made to remove them, are an especial annoyance. To avoid this, corks should not be kept in a warm, dry place, and before inserting them they should be well pressed. "Taper" corks are now invariably preferred to the "straight" form. Fig. 519 shows a modern form of cork-press which is largely used. The motion by which the pressure is effected is direct and simple. Pharmacists who incline to the grotesque in their tastes may prefer the kind shown in Fig. 520; but the practical dispenser will generally choose Lochman's cork-press (see Fig. 521), because the process of pressing the

FIG. 519.

Cork-press.

FIG. 520.



French cork-press.

cork is more effectual, and there is less likelihood of breaking it or cracking the surface in this press than in any other, for the cork is revolved whilst the pressure is gradually increased. The press consists of a cast-iron base, the upper portion of which is hemispherical, with the upper surface slightly corrugated; a corrugated cast-iron wheel is placed upon an axle slightly out of the centre of the curve of the base, so as to afford a gradually diminishing space between the curved surfaces. The wheel has a handle, which is raised when the tapered end of the cork is inserted between the surfaces; the handle is lowered, and the cork revolves whilst being pressed. A finish may be given to corks by the use of "gummed cork-tops." These are circular in form, made of paper, and the name of the pharmacist, or his monogram, is generally printed upon them in colors. These tops have largely supplanted the sealing-wax finish so much used a few years ago.

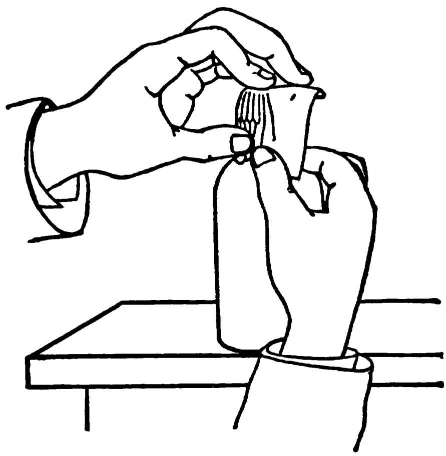
FIG. 521.

Lochman's cork-press.

Capping Bottles.—The practice of capping bottles with paper, kid, baudruche, or other material is a good one, principally because of the

feeling of security it gives to the patient that the contents of the bottle have not been tampered with after being dispensed. Hunt's bottle-caps are largely employed. These consist of fluted caps of colored paper, of various sizes, which are used by adjusting the proper-sized

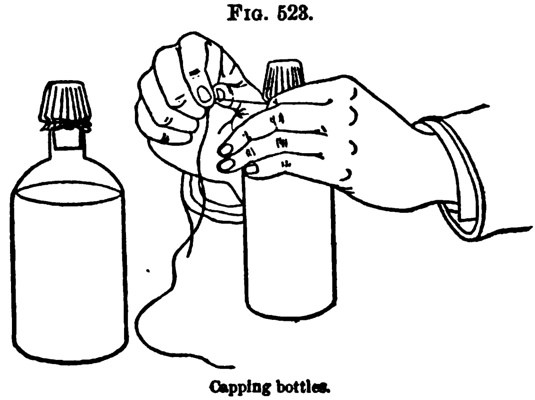
FIG. 522.



Capping bottles.

cap to the corked bottle and tying it on. An equally neat effect may be secured, with a little practice, by capping a bottle with a piece of fancy paper, as shown in Figs. 522 and 523. The paper is held in the centre upon the cork by the forefinger of the left hand, whilst the

FIG. 523.



Capping bottles.

flutes are made by "plaiting" them in with the forefinger and thumb of the right hand: it is then secured by tying with twine, a knot with short ends being preferred, because it is less likely to be interfered with by a messenger, on account of the difficulty of retying it.

QUESTIONS ON CHAPTER LXV.

EXTEMPORANEOUS LIQUID PREPARATIONS.

What is meant by incompatibility?
What is meant by chemical incompatibility?
Give examples of chemical incompatibility,—
1st. Through the precipitation of an insoluble salt, produced by the addition of one solution or salt to another.
Is such an incompatibility always unintentional?
2d. By the decomposition of a salt (in solution) containing a base united with a weak or volatile acid, by the addition of a strong acid.
3d. Through the decomposition of a salt (in solution) containing an acid united with a weak or volatile base, by the addition of a strong alkali.
4th. By the precipitation of alkaloidal salts by the addition to their solutions of alkalies, alkaline salts, or salts which produce insoluble compounds.
5th. By the unsightly discoloration or precipitation due to the formation of inky compounds, produced by bringing astringent solutions containing tannin or similar substances in contact with ferric salts.
6th. By the decomposition of a solid substance without precipitation, because of the formation of products which are soluble in the liquid.
What is meant by pharmaceutical incompatibility?
Give an example,—the result being the separation of active or important constituents.
Give an example,—the result being the separation of inert constituents.
What is meant by therapeutical incompatibility?
In compounding prescriptions, as a general rule, should heat be used in making solutions of solid substances? Why?
When may mixtures which contain more solid material than can be dissolved be filtered before being dispensed?
Give an example.
Give an example where such a mixture should not be filtered.
Is the apothecary justified in using solvents not directed in a prescription, for the purpose of effecting complete solution of the ingredients?
Is the order to be followed in mixing the ingredients of a prescription of any special importance? Why?
Where a difference results from a variation in the order of mixing the ingredients, what rule should be adopted to secure uniform results?
What are mixtures, properly so called?
Is this definition adhered to in extemporaneous pharmacy?
What are emulsions?
What are natural emulsions?
From what are manufactured emulsions usually made?
How are gum-resin emulsions made?
Should powdered gum resins be used in making these? Why?
What is meant by seed emulsions?
What is the object sought by the pharmacist in making emulsions?
What is the English method of making emulsions?
What is meant by "cracking" an emulsion?
How may a cracked emulsion be restored?
What is the Continental method?
What are the most satisfactory proportions of the ingredients to be used?
How are casein emulsions formed?
How is saccharated casein prepared?
What are chondrus emulsions?
How is chondrus prepared for use as an emulsifying agent?
Explain the use of quillaia as an emulsifier.
When it becomes necessary to add alcoholic liquids to emulsions, what precautions are necessary to make a nice, smooth emulsion?
How may emulsions of volatile oils be rendered more stable?

CHAPTER LXVI.

SOLID EXTEMPORANEOUS PREPARATIONS.

Powders, Cachets, Troches, Pills, and Suppositories.

Pulveres. *Powders.*

POWDERS often furnish a convenient and agreeable mode of administering medicines which are not bitter, nauseous, or otherwise offensive to the taste, are not corrosive, nor deliquescent, nor given in large doses. Pulverization facilitates the solution or the extraction of the soluble principles of a substance by extending the surface exposed to the action of the solvent. (See Comminution, page 179.) With the view of establishing a standard and encouraging uniform practice in prescribing certain forms of powders which have become well known, a limited number of compound powders have been admitted to the Pharmacopœia. They are as follows:

PULVIS ANTIMONIALIS. *U.S.* **Antimonial Powder.** [JAMES' POWDER.]

	Metric.	Old form.
Antimony Oxide	33 Gm.	145 grains.
Precipitated Calcium Phosphate	67 Gm.	293 grains.
To make	100 Gm.	1 oz. av.

Mix them intimately.

PULVIS AROMATICUS. *U.S.* **Aromatic Powder.**

	Metric.	Old form.
Ceylon Cinnamon, in No. 60 powder	35 Gm.	7 oz. av.
Ginger, in No. 60 powder	35 Gm.	7 oz. av.
Cardamom, deprived of the capsules and crushed	15 Gm.	3 oz. av.
Nutmeg, in No. 20 powder	15 Gm.	3 oz. av.
To make	100 Gm.	20 oz. av.

Triturate the Cardamom and Nutmeg with a portion of the Ceylon Cinnamon, until they are reduced to a fine powder; then add the remainder of the Cinnamon and the Ginger, and rub them together until they are thoroughly mixed. This powder is used in making Aromatic Fluid Extract (see page 395).

PULVIS CRETÆ COMPOSITUS. *U.S.* **Compound Chalk Powder.**

	Metric.	Old form.
Prepared Chalk	30 Gm.	1½ oz. av.
Acacia, in fine powder	20 Gm.	1 oz. av.
Sugar, in fine powder	50 Gm.	2½ oz. av.
To make	100 Gm.	5 oz. av.

Mix them intimately. This powder is used in making Chalk Mixture (see page 317).

PULVIS EFFERVESCENS COMPOSITUS. *U. S.* **Compound Effervescing Powder.** [SEIDLITZ POWDER.]

	Metric.	Old form.
Sodium Bicarbonate, in fine powder	31 Gm.	480 grains.
Potassium and Sodium Tartrate, in fine powder	93 Gm.	1440 grains.
Tartaric Acid, in fine powder	27 Gm.	420 grains.

Mix the Sodium Bicarbonate intimately with the Potassium and Sodium Tartrate, divide the mixture into 12 equal parts, and wrap each part in a separate paper of some pronounced color, as *blue*.

Then divide the Tartaric Acid also into 12 equal parts, and wrap each part in a separate paper of a color distinctly different from that used for wrapping the mixture, as *white*.

PULVIS GLYCYRRHIZÆ COMPOSITUS. *U. S.* **Compound Powder of Glycyrrhiza.**

	Metric.	Old form.
Senna, in No. 80 powder	180 Gm.	815 grains.
Glycyrrhiza, in No. 80 powder	236 Gm.	418 grains.
Washed Sulphur	80 Gm.	140 grains.
Oil of Fennel	4 Gm.	5 minims.
Sugar, in fine powder	500 Gm.	875 grains.
To make	1000 Gm.	4 oz. av.

Mix the Oil of Fennel thoroughly with about one-half of the Sugar, then add the remainder of the Sugar and the other ingredients, and mix thoroughly. Finally pass the powder through a No. 60 sieve, and keep it in well-closed vessels.

PULVIS IPECACUANHÆ ET OPII. *U. S.* **Powder of Ipecac and Opium.** [DOVER'S POWDER.]

	Metric.	Old form.
Ipecac, in No. 60 powder	10 Gm.	175 grains.
Powdered Opium	10 Gm.	175 grains.
Sugar of Milk, in No. 30 powder	80 Gm.	1400 grains.
To make	100 Gm.	4 oz. av.

Rub them together into a very fine powder.

PULVIS JALAPÆ COMPOSITUS. *U. S.* **Compound Powder of Jalap.** [PULVIS PURGANS.]

	Metric.	Old form.
Jalap, in No. 60 powder	35 Gm.	613 grains.
Potassium Bitartrate, in fine powder	65 Gm.	1137 grains.
To make	100 Gm.	4 oz. av.

Rub them together until they are thoroughly mixed.

PULVIS MORPHINÆ COMPOSITUS. *U. S.* **Compound Powder of Morphine.** [TULLY'S POWDER.]

	Metric.	Old form.
Morphine Sulphate	1 Gm.	7¼ grains.
Camphor	19 Gm.	138 grains.
Glycyrrhiza, in No. 60 powder	20 Gm.	146 grains.
Precipitated Calcium Carbonate	20 Gm.	146 grains.
Alcohol, a sufficient quantity,		
To make	60 Gm.	1 oz. av.

Rub the Camphor with a little Alcohol, and afterwards with the Glycyrrhiza and Precipitated Calcium Carbonate, until a uniform powder is produced. Then rub the Morphine Sulphate with this powder, gradually added, until the whole is thoroughly mixed. Finally, pass the powder through a No. 40 sieve, and transfer it to well-stoppered bottles.

PULVIS RHEI COMPOSITUS. *U. S.* **Compound Powder of Rhubarb.**

	Metric.	Old form.
Rhubarb, in No. 60 powder	25 Gm.	438 grains.
Magnesia	65 Gm.	1137 grains.
Ginger, in No. 60 powder	10 Gm.	175 grains.
To make	100 Gm.	4 oz. av.

Rub them together until they are thoroughly mixed.

Triturationes. *Triturations.*

Triturations constitute a very small class of powders recognized by the Pharmacopœia, but one trituration being official. The intention of forming them into a distinct class is to fix a definite relation between the active ingredient and the diluent. Unless otherwise directed, triturations are to be prepared by the following formula:

Take of	Metric.	Old form.
The Substance	10 Gm.	6 grains.
Sugar of Milk, in moderately fine powder	90 Gm.	54 grains.
To make	100 Gm.	60 grains.

Weigh the Substance and the Sugar of Milk, separately; then place the Substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add about an equal measure of Sugar of Milk, mix well by means of a spatula, and triturate them thoroughly together. Then add fresh portions of the Sugar of Milk, from time to time, until the whole is added, and continue the trituration until the Substance is intimately mixed with the Sugar of Milk and reduced to a fine powder.

TRITURATIO ELATERINI. *U. S.* **Trituration of Elaterin.**

	Metric.	Old form.
Elaterin	10 Gm.	6 grains.
Sugar of Milk, in moderately fine powder	90 Gm.	54 grains.
To make	100 Gm.	60 grains.

Mix them thoroughly by trituration.

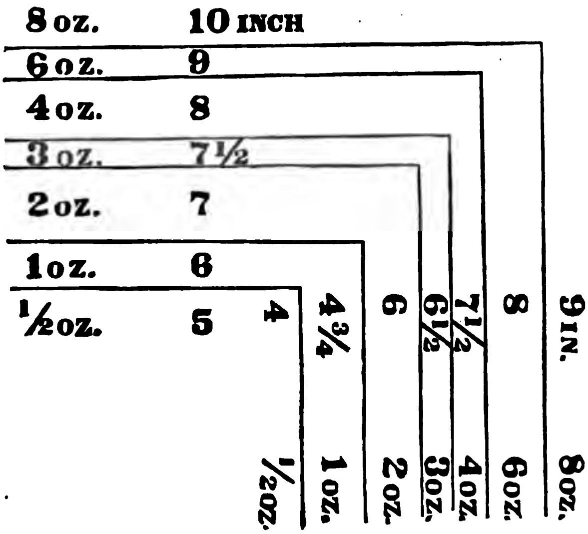
Dispensing of Powders and Solids.

Many of the manipulations required in dispensing powders and solids, such as weighing, measuring, labelling, etc., have been described in previous chapters: therefore only those operations which are peculiar to them, or which have not been considered, will be treated in this chapter.

Folding Packages.—This is one of the first operations taught to the tyro. White paper, of good quality, should be used: it is most economical to buy the paper in quantity (several reams) and have it cut by the

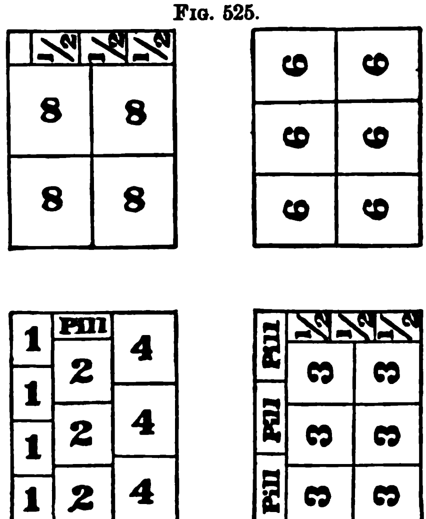
dealer into such sizes as the demands of the business require. The edges of paper which is cut by a machine are much neater than those of hand-cut paper. The size of the sheet of white wrapping-paper is about 36 × 24 inches; this may be cut into halves, quarters, sixths, eighths, and twelfths, or a definite size suited to the bottles and packages adopted may be employed. Jacoby's gauge is useful in this connection: it is illustrated by Figs. 524 and 525. The rectangular lines in Fig. 524 represent the sizes of paper which are suitable for wrapping packages of the sizes indicated,—viz.: 8 oz., 10 × 9 in.; 6 oz., 9 × 8 in.; 4 oz., 8 × 7½ in.; 3 oz., 7½ × 6½ in.; 2 oz., 7 × 6 in.; 1 oz., 6 × 4¾ in.; ½ oz., 5 × 4 in. In Fig. 525 the numbers indicate the method of *cutting a sheet of paper without waste;* the figures 8, 6, 4, 3, 2, etc., refer to the sizes in Fig. 524, and represent papers for 8 oz., 6 oz., 4 oz., 3 oz., etc., packages; the small pieces being used for wrapping pill-boxes.

FIG. 524.



Gauge for cutting paper.

FIG. 525.

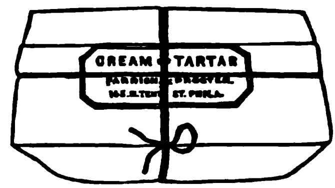


Gauge for cutting paper.

In folding a package, the proper-sized paper is selected and laid upon a flat surface, the substance is deposited in the centre, and the edge nearest the operator is laid against the opposite edge, and a fold made with the thumb and forefinger: the width of the package will depend upon the width of this fold. The end of the partly-formed package on the left hand is now temporarily tucked in, so that the contents shall not fall out, and the package is lifted into an upright position, with the

fold towards the operator; the open upper end is then neatly creased and folded into a wedge-shaped flap. The package is now reversed, and the first partly-formed tuck is loosened and folded into a flap of the same size and shape as the one just made at the other end; the edges of the package are squared and gently pinched into shape, the label is pasted on so that the edge coincides with the edge of the fold, and the package is tied, as shown in Fig. 526.

FIG. 526.



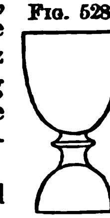
Paper package.

Fig. 527 shows a very convenient twine-reel. Where large quantities of powders having a uniform weight are needed, the powder-measure shown in Fig. 528 may be used. This is made of hard wood, and consists of two ovoid cups of different sizes, joined like an egg-cup. This measure is largely used in preparing seidlitz powders, the larger-sized cup holding the requisite quantity for the alkaline mixture, the smaller cup being intended for the acid.

FIG. 527.

Twine-reel.

FIG. 528.



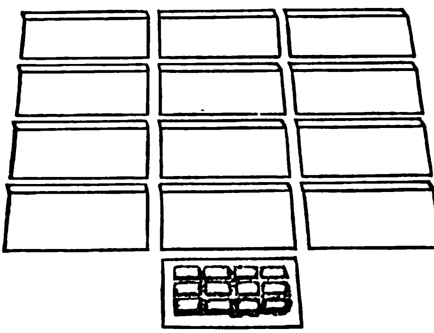
Seidlitz-powder measure.

The measure should never be used without carefully testing its accuracy beforehand. This is done by heaping upon a piece of glazed paper the powder which is to be measured, and then pressing the cup downward through the powder until its edge rests uniformly upon the paper and the measure is evenly filled. The powder will usually have enough cohesive and adhesive properties to cause it to remain in the measure in any position in which it is held. The edge of the cup is then placed upon the powder-paper and slightly tapped, when the contents readily drop out. The weight should be noted, and the operation repeated several times, until the average weight is correctly determined. It will soon be possible, with a little judicious practice, so to regulate the pressure and height of the powder that the variation from the proper weight will practically amount to nothing. This method should not be employed where great accuracy is necessary, and the measure should be repeatedly tested. By use, the edge wears off and the measure holds less: it may be enlarged, however, in the inside by sand-papering it. With due precautions, excellent results may be had by measuring powders, and valuable time saved.

Folding Powders.—This operation is a frequent one, and the practice of accurately dividing powders is one which must be quickly acquired. The best method of attaining proficiency in this respect is to weigh out a definite quantity of a powder (120 grains), and, after dividing it into twelve equal portions, to weigh each portion separately and note the weight, so that any deviation from the proper weight (10 grains) will be discovered. Through practice it will soon be realized that very accurate division may be secured. All the powder-papers

should be creased at once, by folding down a margin on the side, so that they shall be uniform. They should be placed regularly and as close to one another as is convenient. In Fig. 529 the usual arrangement is shown. Where the operator has not sufficient practice to trust to his judgment of the quantity for each powder, the whole quantity may be collected upon a smooth card, flattened into a rectangular shape, and divided with a spatula into the exact number of equal portions required for the number of powder-papers, as shown in Fig. 408. Each portion may then be transferred to its appropriate paper from the card by the spatula.

FIG. 529.



Arrangement of powder-papers.

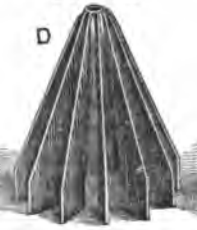
Figs. 530, 531, and 532 illustrate a very simple and ingenious apparatus for dividing powders. It was devised by Jacob C. Michael, and consists of a metallic cup, shaped like a wineglass, into which the powder that is to be divided is dropped. The cup is in two parts, the base C and the body B, these being joined together by a bayonet joint, which permits a ready separation or connection.

A central stem A is firmly attached to the base C; the divider D consists of a heavy metallic cone, the sides having the same angle as

FIG. 530.

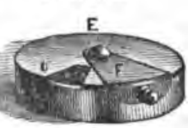
Michael's powder divider.

FIG. 531.



Divider.

FIG. 532.



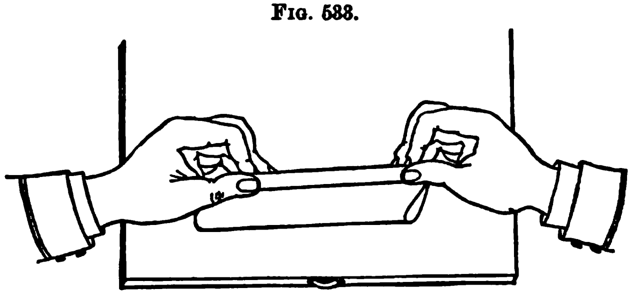
Cover.

that of the body of the cup. There are several dividers accompanying the apparatus; the one shown in the cut has twelve wings, making twelve partitions; the other dividers have respectively ten and eight partitions. The cover to the cup is represented by E, and there is a little sliding door F to this cover. The powder having been thoroughly mixed, is dropped into the cup B, and the divider is placed on top by inserting the end of the stem A into the narrow end of the divider through the circular orifice which traverses the whole length

and allowing it to work its way down to the bottom of the cup; this operation is promoted by slowly rotating the divider, when it will be found that the powder in the cup has been equally divided into twelve parts. The cover E is now placed upon the cup, care being taken to have the edge of one of the partitions of the divider correspond with the side of the door F. The whole apparatus is now turned upside-down, and the stem A is removed by turning the base C and sliding it out of the orifice in the divider. The powder will be deposited upon the cover, and by holding the cover over the powder-paper and opening the little door F over the centre of the paper the powder which was in one of the sections (one-twelfth of the whole) will drop out; the apparatus is then carried to the next paper, the divider rotated again until the contents of another section drop on the paper, and the process is repeated until twelve equal portions are upon as many papers. If eight or ten powders are wanted instead of twelve, the eight or ten divider is used, whilst if a smaller or greater number than eight, ten, or twelve be required, that divider is chosen which is a multiple of the number desired.

The operation of folding the powder is illustrated in Figs. 533, 534, 535, and 536. The uncreased edge of the paper is brought over so

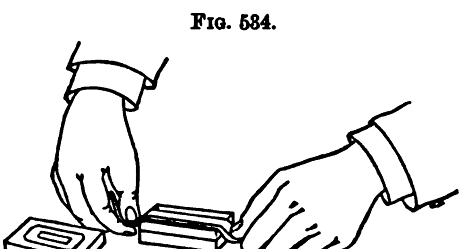
FIG. 533.



Folding the powder.

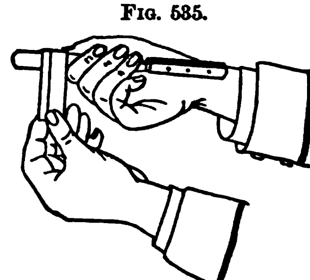
that it lies exactly in the crease, and the fold turned down and folded over towards the operator, the depth of the fold determining the width of the powder.

FIG. 534.



Making the end-creases.

FIG. 535.

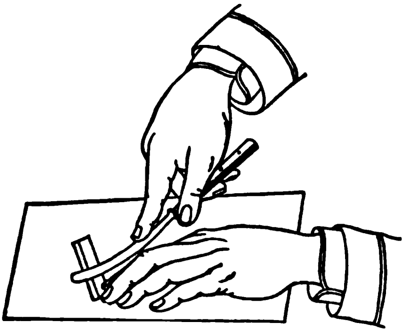


Creasing with the spatula.

When a number of powders are called for, it is best to dispense them in a shallow powder-box (see Fig. 534). It is customary to use the sides

of the box as a gauge. In the hands of an experienced operator neat results are easily obtained in this way, although the use of the powder-folders shown in Figs. 537 and 538 gives a more uniform edge to the powders. A cheap gauge may be made by tacking a piece of

FIG. 536.

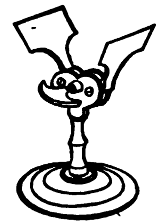


Flattening the powder.

FIG. 537.

Powder-folder.

FIG. 538.



Powder-folder.

tinned iron underneath a convenient shelf, so that a portion having a width slightly less than that of the powder-box will project. A very true edge may be made by folding the powder over a spatula, as shown in Fig. 535, whilst a smooth, flat appearance is given to the powder by pressing down the folds with the blade of the spatula, as shown in Fig. 536. The paper used for folding powders should be thin, glazed cap paper, and for deliquescent substances waxed or paraffin paper should be employed.

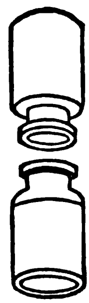
Cachets, or Wafer Capsules.

The credit of bringing the *cachet*, or, as it is sometimes termed, *cachet de pain*, into use belongs to Limousin, of Paris. Wafers have been in use many years. Wafer-sheet is made by pouring a mixture of flour and water upon hot greased plates, or between two hot polished cylinders separated at a proper distance, so that the water is evaporated and a sheet of wafer produced. The properties of wafer-sheet admirably fit it for administering nauseous powders. When dry, it is in non-adhesive, stiff, somewhat brittle sheets, slightly thicker than ordinary cardboard. It is tasteless, and harmless when taken into the stomach. When moistened with water, its character is entirely changed: it becomes soft, elastic, and slippery. Powders may be administered by Kollme's method, by floating a piece of wafer-sheet upon water, and, when thoroughly softened, passing a tablespoon underneath and lifting it out, then depositing the powder in the centre and folding over the corners so as thoroughly to enclose it; if water is then poured into the spoon, the concealed powder may be swallowed without any disagreeable taste being perceived.

The cachet is an improvement on the above, because no more wafer-sheet is used than is absolutely necessary to enclose the powder, and thus the bulk is diminished. Cachets are lenticular or spoon-shaped disks of wafer-sheet, of various sizes. The powder is deposited in the dry cachet, and the margin is moistened with water. An empty cachet of

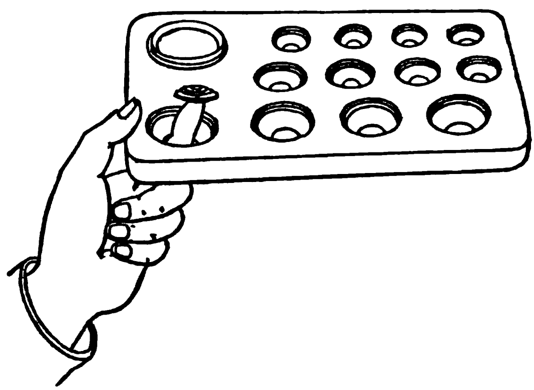
exactly the same size is placed on top, with the convexity upward, and pressure is made upon the margin, with the effect of tightly sealing the cachet and enveloping the powder. Elaborate apparatus—the necessity for which, however, is not apparent—has been devised to effect the sealing of the cachets. The simplest method upon the small scale is as fol-

FIG. 539.



Bottles for sealing cachets.

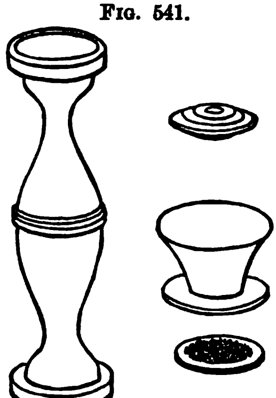
FIG. 540.



Limousin's cachet-board.

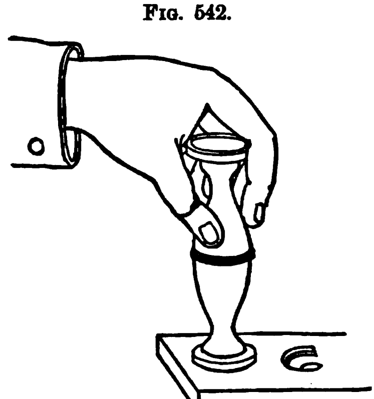
lows: two bottles are provided (a morphine-bottle for the middle size answers very well), and, one of the cachets being placed upon the lip of one bottle, the powder is carefully deposited in the centre without soiling the outside edge; the margin of an empty cachet of the same size is then

FIG. 541.



Cachet-wetter and funnel.

FIG. 542.



Sealing the cachet.

moistened by quickly passing it over a piece of wet felt, and is laid upon the cachet containing the powder; the lip of the other bottle is now applied to the cachet with sufficient pressure to seal it effectually. The position of the bottles is shown in Fig. 539. Limousin's improved method is similar in principle, although, of course, more finished. A

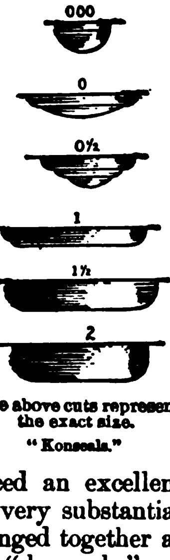
board, with depressed perforations for three sizes, is shown in Fig. 540. Empty cachets are placed upon the depressions, and the powder is deposited in the centre with the aid of the small powder-funnel (see Fig. 541). The "wetter and presser" is shown to the left of the funnel; this is of two kinds of wood, joined in the middle,—one end being hard, light-colored, and highly polished, the other being dark-colored and somewhat absorbent. The end of the latter is used to moisten the margin of the cachet, by first placing it upon a piece of moist felt and then applying it to the cachet; an empty cachet is now laid upon the one containing the powder, and the "presser" end is applied with some force, so as to seal the cachet (see Fig. 542): the sealed cachet is pushed up from below, as shown in Fig. 540.

A less expensive apparatus for filling and sealing cachets than that made by Limousin may be obtained from the German importing houses. A rectangular sheet of thick rubber cloth is perforated with twelve circular holes, each large enough to hold an empty cachet; the powder is deposited in the centre of the cachet through a small funnel; the inner edge of an empty cachet is dampened by rubbing it for a moment upon a piece of cotton flannel moistened with water, the moistened cachet is laid upon the one containing the powder so as to enclose it, and the presser, which is armed at its base with three needles and has a spring in the handle, is applied so that the cachet is sealed, and when the spring is released the needles penetrate the edge of the finished cachet sufficiently so that it can be lifted and dropped into the box without handling it.

FIG. 542a.

"Konseal" apparatus.

FIG. 542b.



The above cuts represent the exact size.

"Konseals."

J. M. Grosvenor & Co., of Boston, have introduced an excellent apparatus for dispensing cachets. It is made in a very substantial manner, and consists of three nickeled metal plates hinged together as shown in Fig. 542a. The cachets, which are termed "konseals," are made of thinner material than ordinary cachets, and the finished cachet is less bulky and neater in appearance.

The saucer-shaped cachets are pressed with the fingers into the inner circles of the bottom plate, and also into those on the left-hand plate; the right-hand plate is then laid on the bottom plate, and the medicated powder dropped through the funnel into the cachet. Large doses may be pressed with a thimble furnished for the purpose, and thus smaller cachets may be used than are possible in ordinary apparatus.

When the cachets are filled, the filling-plate is lifted and a dampening-roller passed over the edges of the empty capsules in the left-hand plate; the latter is then closed over the bottom plate, and a slight pressure seals the cachet. On opening the apparatus the filled cachets may be easily removed by pushing each one gently out with the finger.

Fig. 542*b* shows the exact sizes of the wafer konseals. No. 000 permits the administration of a cachet not larger than a large-sized pill.

The name "konseals" was adopted by J. M. Grosvenor & Co. as shorter and better adapted for prescription use than "Morstadt's cachets," which was their original name. They were contrived by Karl Morstadt, of Prague, Austria.

It is greatly to be regretted that wafer-capsules are not more frequently prescribed. They have many substantial advantages: the substance is rendered tasteless by their use, and yet is easily liberated in the stomach in a pulverulent condition, and this is well known to be the most favorable solid form for solution in the gastric fluids; the knack of swallowing them is easily acquired; the pharmacist has the great advantage of furnishing preparations which are not ready-made, and the purity of the ingredients can be personally vouched for.

Tabellæ. *Tablets, Tablet-triturates.*

Tablets, or tablet-triturates, may be defined as minute disk-like masses of medicinal powders, the basis usually consisting of powdered sugar. The powder is held together and the tablet retains its shape through the adhesion of the particles developed by the use of a volatile liquid, thus differing from lozenges, which are usually made from a mass in which tenacity is communicated by a mucilage, adhesive paste, or a similar substance. (See Trochisci.)

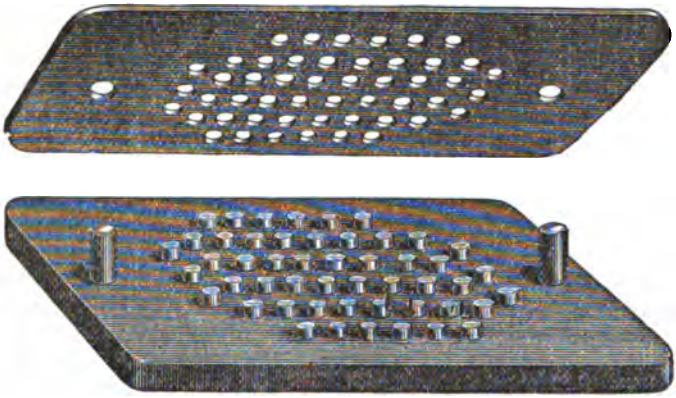
Tablet-triturates originated with Dr. Robert M. Fuller, and neither process nor apparatus is patented. Since his first communication on the subject, in 1878, they have been largely manufactured, and pharmacists owe a debt to Dr. Fuller for voluntarily giving them a very neat and ingenious process whereby many medicines can be satisfactorily administered.

The tablet is made by pressing a paste into perforations made in a plate of hard rubber, metal, glass, or other suitable material. These holes are of uniform diameter, and the plate must have a uniform thickness throughout. The number of holes in the plate is determined by their relative size, plates having been made with as many as three hundred perforations. The one shown in Fig. 543 has fifty. The tablets made by the use of various plates weigh from half a grain to four grains.

In order to remove the tablets from the holes in which they are made a plate is used which is studded with an equal number of pegs fastened

securely in a base plate (see the lower plate shown in Fig. 544). These pegs are longer than the thickness of the upper plate, and they are so arranged that they exactly fit the perforations in the upper plate. Two pegs still longer and thicker are placed at the ends, so that when they are inserted in corresponding holes in the upper plate accurate registration is secured.

FIGS. 543, 544.



Tablet machine.

In using the apparatus, the upper plate is placed upon a pill-tile or plate of glass, and the paste is spread upon the upper surface and rubbed into the small holes with a spatula. When all of the holes are filled, the excess of paste is brushed from the surface and the upper plate lifted over the lower plate and laid upon it so that the two long pegs enter the holes. Now, by pressing firmly but gently upon the upper plate the pegs are forced upward slowly until the plates come together and a tablet rests upon the top of each peg; the apparatus is then set aside to permit the tablets to dry sufficiently to be handled, when they are taken off, and the plates, after brushing, are ready for another operation.

It will usually be found desirable to have several sets of plates, so that they may be worked continuously, the tablets drying upon one whilst another is being used for forming the tablets. The paste may be made by adding the medicating ingredient in fine powder to finely powdered sugar or sugar of milk and moistening it with alcohol; in some rare cases a little powdered acacia may be needed, but care must be observed not to get the paste too tenacious nor too soft, as there may be difficulty in forcing the tablets out of the perforations, or they may take a long time to dry. Tablets used for hypodermic medication may be advantageously made by this process. Accurate adjustment of the ingredients and prolonged trituration, so that each tablet shall contain its due proportion of activity and thorough desiccation, are the important details in the manufacture of tablet-triturates.

Tablet-triturates have been made "in blank,"—that is, without medication,—from powdered sugar of milk, a little acacia, and 85 per cent.

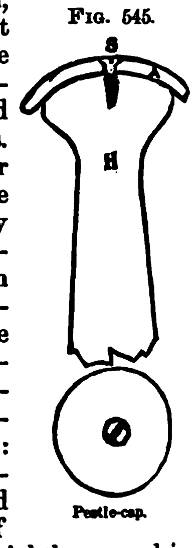
alcohol, or with water alone; the object here is to medicate the blank tablets subsequently by dropping upon each a concentrated liquid medicine in definite quantity. Such tablets have been termed by Dr. Fuller *tablet-saturates*. The mode employed in medicating tablet-saturates is to arrange a number of blank tablets upon a glass plate, either in contact or separated. In the former case the concentrated liquid or fluid extract is poured upon the tablets in the proper proportion, and by permitting the liquid to remain in contact under cover long enough for each tablet to become saturated uniformly, and then exposing the tablets to the air until they are dry, they may be rapidly medicated; or if the tablets are arranged separately upon the plate, the proper quantity of the fluid extract may be dropped from a pipette upon each tablet.

Trochisci. *Troches.*

Troches, or lozenges, are solid, discoid or cylindrical masses, consisting chiefly of medicinal powders, sugar, and mucilage. They are intended to be used by placing them in the mouth and permitting them to remain until, through slow solution or disintegration, their purpose of mild medication is effected. It is obvious that very powerful or disagreeable remedies cannot be administered in this way. The formation of the "lozenge mass" is the most important part of the operation: the dry powders must be made into a tenacious mass which shall possess sufficient plasticity to enable it to be rolled into a flat cake without crumbling: it must not retain moisture so long as to occasion too much delay in drying the troches, and the troches must not be brittle through want of sufficient adhesiveness. Mucilage of tragacanth has been found best to serve the purpose of causing the adhesion of the powders.

Making the Mass.—The best method of making the mass is first to prepare the mucilage according to the formula, and, having mixed and sifted the powders, add sufficient mucilage to make a mass of the proper consistence: the quantity always depends upon the character of the powder: if the latter is absorbent, more mucilage is required than if the powder is made up largely of extracts. The usual method of mixing powdered tragacanth or acacia with the dry powders, and then trusting to the addition of the right proportion of water, is generally disappointing in the hands of the inexperienced, almost invariably producing too moist a mass. Upon the large scale the manufacturer employs a mixing-machine to form the mass; upon the small scale the pharmacist uses the mortar and pestle. The mortar-clamp shown in Fig. 383 is very useful in this connection and in working tough masses. Hahn's pestle-cap will save blistering the hands of the inexperienced: this device, shown in Fig. 545, consists of a brass cup-shaped cap, A, perforated in the centre, and screwed to the top of the pestle H at S, so as to permit of the slow revolution of the cap when the pestle is tightly grasped in the hand.

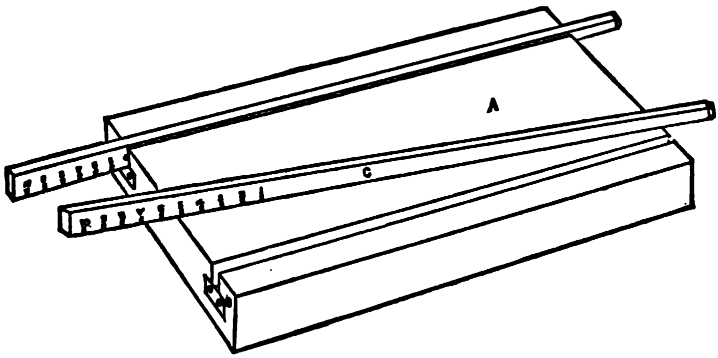
FIG. 545.



Pestle-cap.

Rolling the Mass.—When the mass is made, it must be formed into a flat cake by placing it upon a hard, level, dusted surface and rolling

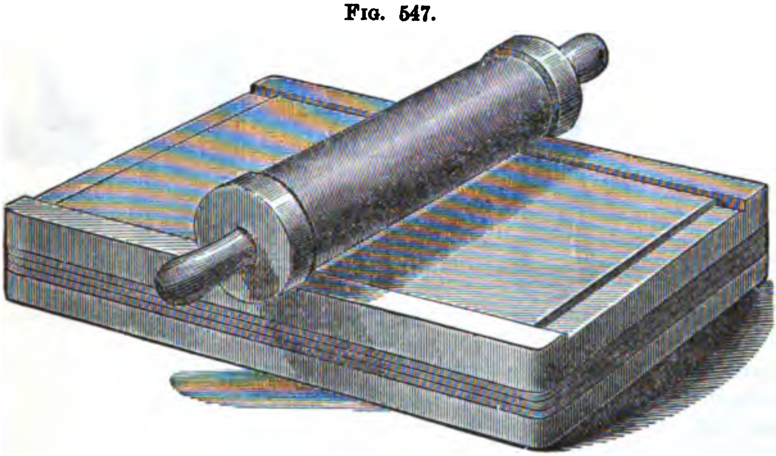
FIG. 546.



Slocum's lozenge-board.

it with a cylindrical roller: the thickness of the cake determines the weight of the lozenge, and hence it is more exact to have some means

FIG. 547.



Harrison's lozenge-board.

of adjusting the thickness. In Slocum's lozenge-board (see Fig. 546) this is ingeniously effected by the use of tapering oak strips, C, which

FIG. 548.

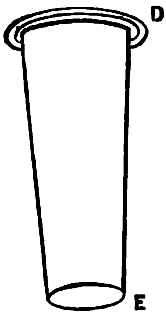
Sectional view of Harrison's lozenge-board.

slide in inclined furrows; the handles of the strips are graduated, having saw-kerfs at regular intervals; the brass plate B permits these to be

accurately adjusted and held, so that both strips project uniformly above the board. By pushing both strips forward, greater thickness of the lozenge-cake is secured.

Harrison's lozenge-board is shown in Fig. 547 and Fig. 548. The

FIG. 549.

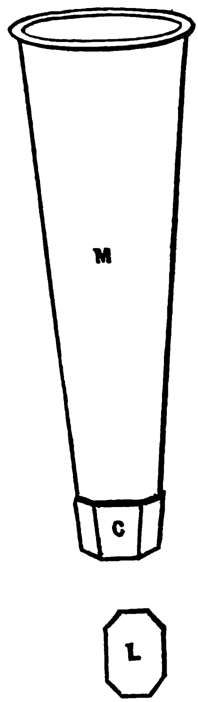


Lozenge-punch.

FIG. 549a.

Franciscus lozenge-punch.

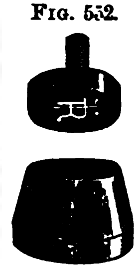
FIG. 550.



Lozenge-punch, steel cutter.

FIG. 551.

FIG. 552.



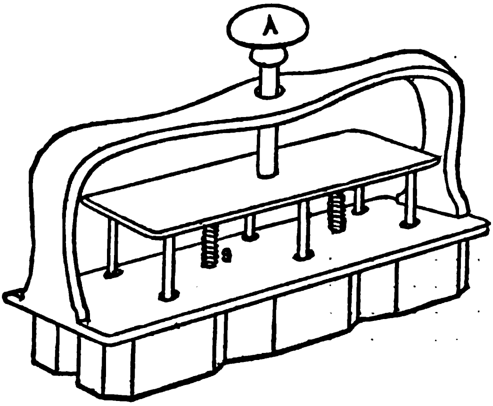
Lozenge-cutter, with die.

board is surrounded by a frame, and the former can be elevated or depressed uniformly by turning the screw shown in the sectional view in Fig. 548. The handles of the roller form one continuous piece, running through a longitudinal hole through its centre: this permits the handles to be grasped tightly whilst the roller revolves. Lozenge-rollers should be true cylinders, and are generally made of hard wood: steel rollers and glass rollers have been used, however; these are both made hollow, so that hot water can be introduced through the holes made where the handles are screwed in.

Cutting the Troches.—Troches are cut by cylindrical or conical punches, often made of tinned iron, as shown in Fig. 549, but preferably of steel (see the Franciscus lozenge-punch, Fig. 549*a*). Fig. 550 shows a very good punch, having a hardened steel octagonal cutter, C, soldered to a hollow conical handle, M. Fig. 551 represents a very complete lozenge-cutter with a circular die, which stamps a letter upon the lozenge in addition to cutting it. It was obtained by the author from Chicago. It is made very substantially, and is accom-

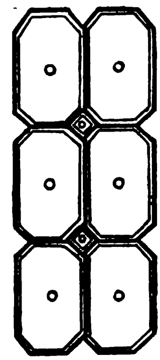
panied by a cutter and a die for oval lozenges. Fig. 553 shows an excellent cutter, which accurately cuts six lozenges at once; it was devised by a Western pharmacist. Fig. 554 gives the end-view. The cutter is

FIG. 553.



Lozenge-cutter.

FIG. 554.



End-view of the same.

placed upon the soft mass and pressed down until the edges touch the board; by pressing upon the handle A the lozenges are forced out of the cutters, the springs S causing the pushers to resume their original position.

TROCHISCI ACIDI TANNICI. *U. S.* Troches of Tannic Acid.

	Metric.	Old form.
Tannic Acid	6 Gm.	98 grains.
Sugar, in fine powder	65 Gm.	2 oz. av. 128 gr.
Tragacanth, in fine powder	2 Gm.	81 grains.
Stronger Orange Flower Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with Stronger Orange Flower Water, form a mass, to be divided into 100 troches.

TROCHISCI AMMONII CHLORIDI. *U. S.* Troches of Ammonium Chloride.

	Metric.	Old form.
Ammonium Chloride, in fine powder	10 Gm.	154 grains.
Extract of Glycyrrhiza, in fine powder . . .	25 Gm.	386 grains.
Tragacanth, in fine powder	2 Gm.	31 grains.
Sugar, in fine powder	50 Gm.	1 oz. av. 334 gr.
Syrup of Tolu, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with Syrup of Tolu, form a mass, to be divided into 100 troches.

TROCHISCI CATECHU. *U. S.* Troches of Catechu.

	Metric.	Old form.
Catechu, in fine powder	6 Gm.	93 grains.
Sugar, in fine powder	65 Gm.	2 oz. av. 128 gr.
Tragacanth, in fine powder	2 Gm.	31 grains.
Stronger Orange Flower Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with the Stronger Orange Flower Water, form a mass, to be divided into 100 troches.

TROCHISCI CRETÆ. *U. S.* Troches of Chalk.

	Metric.	Old form.
Prepared Chalk	25 Gm.	386 grains.
Acacia, in fine powder	7 Gm.	108 grains.
Spirit of Nutmeg	3 C.c.	48 minims.
Sugar, in fine powder	40 Gm.	1 oz. av. 180 gr.
Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders with the Spirit of Nutmeg until they are thoroughly mixed; then, with water, form a mass, to be divided into 100 troches.

TROCHISCI CUBEBÆ. *U. S.* Troches of Cubeb.

	Metric.	Old form.
Oleoresin of Cubeb	4 Gm.	61 grains.
Oil of Sassafras	1 C.c.	16 minims.
Extract of Glycyrrhiza, in fine powder	25 Gm.	386 grains.
Acacia, in fine powder	12 Gm.	185 grains.
Syrup of Tolu, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then add the Oleoresin and Oil, and incorporate them with the mixture. Lastly, with Syrup of Tolu, form a mass, to be divided into 100 troches.

TROCHISCI FERRI. *U. S.* Troches of Iron.

	Metric.	Old form.
Ferric Hydrate, dried at a temperature not exceeding 80° C. (176° F.)	30 Gm.	463 grains.
Vanilla, cut into slices	1 Gm.	15 grains.
Sugar, in fine powder	100 Gm.	3 oz. av. 230 gr.
Mucilage of Tragacanth, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the Vanilla, first, with a portion of the Sugar to a uniform powder, and afterwards with the Ferric Hydrate and the remainder of the Sugar, until they are thoroughly mixed. Then, with Mucilage of Tragacanth, form a mass, to be divided into 100 troches.

TROCHISCI GLYCYRRHIZÆ ET OPII. *U.S.* **Troches of Glycyrrhiza and Opium.**

	Metric.	Old form.
Extract of Glycyrrhiza, in fine powder	15 Gm.	281 grains.
Powdered Opium	0.5 Gm.	7¾ grains.
Acacia, in fine powder	12 Gm.	185 grains.
Sugar, in fine powder	20 Gm.	308 grains.
Oil of Anise	0.2 C.c.	3 minims.
Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then add the Oil of Anise (equivalent to about 4 drops), and incorporate it with the mixture. Lastly, with Water, form a mass, to be divided into 100 troches.

TROCHISCI IPECACUANHÆ. *U.S.* **Troches of Ipecac.**

	Metric.	Old form.
Ipecac, in No. 60 powder	2 Gm.	31 grains.
Tragacanth, in fine powder	2 Gm.	31 grains.
Sugar, in fine powder	65 Gm.	2 oz. av. 128 gr.
Syrup of Orange, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with Syrup of Orange, form a mass, to be divided into 100 troches.

TROCHISCI KRAMERIÆ. *U.S.* **Troches of Krameria.**

	Metric.	Old form.
Extract of Krameria	6 Gm.	93 grains.
Sugar, in fine powder	65 Gm.	2 oz. av. 128 gr.
Tragacanth, in fine powder	2 Gm.	31 grains.
Stronger Orange Flower Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with Stronger Orange Flower Water, form a mass, to be divided into 100 troches.

TROCHISCI MENTHÆ PIPERITÆ. *U.S.* **Troches of Peppermint.**

	Metric.	Old form.
Oil of Peppermint	1 C.c.	16 minims.
Sugar, in fine powder	80 Gm.	2 oz. av. 360 gr.
Mucilage of Tragacanth, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the Oil of Peppermint and the Sugar together until they are thoroughly mixed; then, with Mucilage of Tragacanth, form a mass, to be divided into 100 troches.

TROCHISCI MORPHINÆ ET IPECACUANHÆ. *U. S.* Troches of Morphine and Ipecac.

	Metric.	Old form.
Morphine Sulphate	0.16 Gm.	2½ grains.
Ipecac, in No. 60 powder	0.50 Gm.	7¾ grains.
Sugar, in fine powder	65 Gm.	2 oz. av. 128 gr.
Oil of Gaultheria	0.2 C.c.	3 minims.
Mucilage of Tragacanth, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then add the Oil of Gaultheria (equivalent to about 4 drops), and incorporate it with the mixture. Lastly, with Mucilage of Tragacanth, form a mass, to be divided into 100 troches.

TROCHISCI POTASSII CHLORATIS. *U. S.* Troches of Potassium Chlorate.

	Metric.	Old form.
Potassium Chlorate, in fine powder	30 Gm.	463 grains.
Sugar, in fine powder	120 Gm.	4 oz. av. 102 gr.
Tragacanth, in fine powder	6 Gm.	93 grains.
Spirit of Lemon	1 C.c.	16 minims.
Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Mix the Sugar with the Tragacanth and the Spirit of Lemon by trituration, in a mortar; then transfer the mixture to a sheet of paper, and, by means of a bone spatula, mix with it the Potassium Chlorate, being careful, by avoiding trituration or pressure, to prevent the mixture from igniting or exploding. Lastly, with Water, form a mass, to be divided into 100 troches.

TROCHISCI SANTONINI. *U. S.* Troches of Santonin.

	Metric.	Old form.
Santonin, in fine powder	3 Gm.	46 grains.
Sugar, in fine powder	110 Gm.	3 oz. av. 384 gr.
Tragacanth, in fine powder	3 Gm.	46 grains.
Stronger Orange Flower Water, a sufficient quantity,		
To make	100 troches.	100 troches.

Rub the powders together until they are thoroughly mixed; then, with Stronger Orange Flower Water, form a mass, to be divided into 100 troches. Troches of Santonin should be kept in dark amber-colored vials.

TROCHISCI SODII BICARBONATIS. *U. S.* Troches of Sodium Bicarbonate.

	Metric.	Old form.
Sodium Bicarbonate	20 Gm.	308 grains.
Sugar, in fine powder	60 Gm.	2 oz. av. 51 gr.
Nutmeg, bruised	1 Gm.	15 grains.
Mucilage of Tragacanth, a sufficient quantity,		
To make	100 troches.	100 troches.

Triturate the Nutmeg with the Sugar, gradually added, until they are reduced to a fine powder, and mix this intimately with the Sodium Bicarbonate; then, with Mucilage of Tragacanth, form a mass, to be divided into 100 troches.

TROCHISCI ZINGIBERIS. *U. S.* **Troches of Ginger.**

	Metric.	Old form.
Tincture of Ginger	20 C.c.	324 minims.
Tragacanth, in fine powder	4 Gm.	62 grains.
Sugar, in fine powder	130 Gm.	4 oz. av. 256 gr.
Syrup of Ginger, a sufficient quantity,		
To make	100 troches.	100 troches.

Mix the Tincture of Ginger with the Sugar, and, having exposed the mixture to the air until dry, reduce it to a fine powder. To this add the Tragacanth, and mix thoroughly. Lastly, with Syrup of Ginger, form a mass, to be divided into 100 troches.

Confectiones. *Confections.*

Confections are saccharine, soft solids, in which one or more medicinal substances are incorporated with the object of affording an agreeable form for their administration, and a convenient method for their preservation. Under the old names of *conserves* and *electuaries*, these preparations have been in use for centuries. In the preparation of confections the basis is finely powdered sugar, and the medicinal ingredients must be brought to the condition of a smooth paste or introduced as a fine powder or liquid. Only *two* confections are official.

Official Confections.

Name.	Proportions.
Confectio Rosæ.	80 Gm. Red Rose, in No. 60 powder; 640 Gm. Powdered Sugar; 120 Gm. Clarified Honey; 160 C.c. Rose Water.
Confectio Sennæ.	100 Gm. Senna, in No. 60 powder; 5 Gm. Oil of Coriander; 160 Gm. Cassia Fistula, bruised; 100 Gm. Tamarind; 70 Gm. Prune; 555 Gm. Fig, bruised; 555 Gm. Powdered Sugar; Water, sufficient to make 1000 Gm.

CONFECTIO ROSÆ. *U. S.* **Confection of Rose.**

	Metric.	Old form.
Red Rose, in No. 60 powder	80 Gm.	1 oz. av.
Sugar, in fine powder	640 Gm.	8 oz. av.
Clarified Honey	120 Gm.	1½ oz. av.
Stronger Rose Water	160 C.c.	2 fl. oz.
To make	1000 Gm.	12½ oz. av.

Rub the Red Rose with the Stronger Rose Water previously heated to 65° C. (149° F.), then gradually add the Sugar and Honey, and beat the whole together until a uniform mass results.

CONFECTIO SENNÆ. *U. S.* **Confection of Senna.**

	Metric.	Old form.
Senna, in No. 60 powder	100 Gm.	700 grains.
Cassia Fistula, bruised	160 Gm.	2½ oz. av.
Tamarind	100 Gm.	700 grains.
Prune, sliced	70 Gm.	490 grains.
Fig, bruised	120 Gm.	2 oz. av.
Sugar, in fine powder	555 Gm.	8 oz. av. 385 gr.
Oil of Coriander	5 Gm.	30 minims.
Water, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Place the Cassia Fistula, Tamarind, Prune, and Fig in a close vessel with 500 C.c. [old form 8 fl. oz.] of Water, and digest for three hours, by means of a water-bath. Separate the coarser portions with the hand, and rub the pulpy mass, first through a coarse hair sieve, and then through a fine one, or through a muslin cloth. Mix the residue with 150 C.c. [old form 2½ fl. oz.] of Water, and, having digested the mixture for a short time, treat it as before, and add the product to the pulpy mass first obtained. Then, by means of a water-bath, dissolve the Sugar in the pulpy liquid, and evaporate the whole, in a tared vessel, until it weighs 895 Gm. [old form 14 oz. av. 140 gr.]. Lastly, add the Senna and the Oil of Coriander, and incorporate them thoroughly with the other ingredients while they are yet warm.

Massæ. *Masses.*

Pill masses are official in the U. S. Pharmacopœia under the title of "Massa." As the official preparations are usually kept in bulk by pharmacists, and are permanent preparations, there is a manifest propriety in making a distinct class of them. There are *three* official masses.

Official Masses.

Name.	Proportions.	Preparation.
Massa Copaibæ.	94 Gm. Copaiba; 6 Gm. Magnesia (recently prepared).	Mix them intimately, and set the mixture aside until it concretes into a pilular mass.
Massa Ferri Carbonatis.	100 Gm. Ferrous Sulphate; 100 Gm. Sodium Carbonate; 38 Gm. Clarified Honey; 25 Gm. Sugar, in coarse powder; Syrup and Distilled Water, of each, a sufficient quantity, to make 100 Gm.	Dissolve the Ferrous Sulphate and the Sodium Carbonate separately in boiling Distilled Water, add 20 C.c. Syrup to the Solution of Ferrous Sulphate, and mix the solutions. When cold, pour off the supernatant liquid, and wash the precipitate with a mixture of 1 volume of Syrup to 19 volumes of Water. Drain the precipitate, mix it with the Honey and Sugar, and evaporate it to 100 Gm.
Massa Hydrargyri.	33 Gm. Mercury; 5 Gm. Glycyrrhiza, powdered; 25 Gm. Althæa, powdered; 3 Gm. Glycerin; 34 Gm. Honey of Rose.	Triturate the Mercury with the Honey of Rose and Glycerin until it is extinguished, add gradually the Glycyrrhiza and Althæa, and continue the trituration until globules of Mercury cease to be visible.

MASSA COPAIBÆ. *U. S.* **Mass of Copaiba.** [SOLIDIFIED COPAIBA.]

	Metric.	Old form.
Copaiba	94 Gm.	4 oz. av.
Magnesia	6 Gm.	112 grains.
Water, a sufficient quantity.		

Triturate the Magnesia with a little Water, in a capsule, until the powder is uniformly dampened throughout. Then gradually incorporate with it the Copaiba, so that a uniform mixture may result, place the capsule on a water-bath, and heat during half an hour, frequently stirring. Lastly, transfer the mixture to a suitable vessel, and set this aside until the mass has acquired a pilular consistence.

MASSA FERRI CARBONATIS. *U. S.* **Mass of Ferrous Carbonate.**
[VALLET'S MASS.]

	Metric.	Old form.
Ferrous Sulphate, in clear crystals	100 Gm.	8 oz. av.
Sodium Carbonate	100 Gm.	8 oz. av.
Clarified Honey	38 Gm.	8 oz. av.
Sugar, in coarse powder	25 Gm.	2 oz. av.
Syrup,		
Distilled Water, each, a sufficient quantity,		
To make	100 Gm.	8 oz. av.

Dissolve the Ferrous Sulphate and the Sodium Carbonate, each separately, in 200 C.c. [old form 1 pint] of boiling Distilled Water, and, having added 20 C.c. [old form 1½ fl. oz.] of Syrup to the solution of the Iron salt, filter both solutions, and allow them to become cold. Introduce the solution of Sodium Carbonate into a bottle having a capacity of about 500 C.c. [old form 2¼ pints], and gradually add the solution of the Iron salt, rotating the flask constantly or frequently, until carbonic acid gas no longer escapes. Add a sufficient quantity of Distilled Water to fill the bottle; then cork the bottle and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and, having mixed Syrup and Distilled Water in the proportion of 1 volume of Syrup to 19 volumes of Distilled Water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste. Drain the precipitate on a muslin strainer, and express as much of the Water as possible. Lastly, mix the precipitate at once with the Honey and Sugar, and, by means of a water-bath, evaporate the mixture in a tared capsule, with constant stirring, until it is reduced to 100 Gm. [old form 8 oz. av.].

MASSA HYDRARGYRI. *U. S.* **Mass of Mercury.**
[PILULA HYDRARGYRI. BLUE MASS. BLUE PILL.]

	Metric.	Old form.
Mercury	33 Gm.	5 oz. av. 122 gr.
Glycyrrhiza, in No. 60 powder	5 Gm.	350 grains.
Althæa, in No. 60 powder	25 Gm.	4 oz. av.
Glycerin	3 Gm.	8 fl. dr.
Honey of Rose	34 Gm.	4½ fl. oz.
To make	100 Gm.	16 oz. av.

Triturate the Mercury with the Honey of Rose and Glycerin until it is extinguished.[1] Then gradually add the Glycyrrhiza and Althæa, and continue the trituration until globules of mercury are no longer visible under a lens magnifying at least ten diameters.

If a portion of the Mass be triturated, in a mortar, with warm acetic acid, the filtrate should not become more than slightly opalescent on the addition of a few drops of hydrochloric acid (limit of *mercurous oxide*).

If another portion of the Mass be digested with warm, diluted hydrochloric acid and a little purified animal charcoal, the filtrate should not be affected by hydrogen sulphide T.S., or by stannous chloride T.S. (absence of *mercuric oxide*).

Apparatus for Kneading Masses.—In making masses upon the large scale it is necessary to use mechanical contrivances to secure a thorough admixture of the various ingredients. One of the simplest forms consists of two smooth iron rollers, geared so that they may be made to approach or recede from each other, revolving in opposite directions and at slightly different rates of speed. The mass roughly mixed is repeatedly passed through the rollers, which may be hollow, so that steam can be introduced inside and thus heated (some masses requiring such treatment), or the rollers can be heated directly on the outside by a row of spirit lamps placed on a table immediately under them. Figs. 555 and 556 illustrate two forms of Day's pill mass mixer. Fig. 555 represents a hand machine having a capacity of three pounds, and Fig. 556 one intended to be run by "power," with a capacity of thirty pounds. They are made of iron and steel, the hoppers are lined with porcelain, and the machine is arranged so that the mass can be discharged when finished, by inclining the machine and revolving the mixers.

Fig. 555.

Day's pill mass mixer.

Fig. 556.

Day's pill mass mixer.

QUESTIONS ON CHAPTER LXVI.

SOLID EXTEMPORANEOUS PREPARATIONS.

Antimonial powder—Give the Latin official name. Give the synonyme. How is it made?
Aromatic powder—What are the ingredients?
Compound chalk powder—Give the Latin official name. How is it prepared?
Compound effervescing powder—Give the Latin official name. Give the synonyme. What are the ingredients?

[1] If the mixture should become so thick that the mercury ceases to disappear, a few drops of water should be added.

Compound powder of glycyrrhiza—Give the Latin official name.
What are the ingredients?
Powder of ipecac and opium—Give the Latin official name.
Give the synonyme. What are its ingredients and their proportions?
Compound powder of jalap—Give the Latin official name.
What are the ingredients?
Compound powder of morphine—Give the Latin official name.
Give the synonyme. What are the ingredients?
What is the proportion of morphine sulphate?
Compound powder of rhubarb—Give the Latin official name.
What are the ingredients?
Give the general formula for triturations.
What trituration is official?
Give its formula.
How may powders of uniform size and weight be divided without having to weigh each powder?
How can powder papers be folded so as to present a uniform appearance?
What is a cachet, or, as sometimes called, "cachet de pain"?
How are cachets used?
How is wafer-sheet prepared?
How is it used for taking powders?
How may bottles be utilized for sealing cachets?
Describe Hahn's pestle-cap.
For what purpose is it used?
What are tablet triturates? How are they made?
What are troches, and how are they used?
How is the mass prepared for making troches?
How are troches cut?
What contrivances are used to give them uniformity?
Give the English official names of the following varieties of troches and the quantity of the medicinal ingredient contained in one of each:
Trochisci acidi tannici.
Trochisci ammonii chloridi.
Trochisci catechu.
Trochisci cretæ.
Trochisci cubebæ.
Trochisci ferri.
Trochisci glycyrrhizæ et opii.
Trochisci ipecacuanhæ.
Trochisci krameriæ.
Trochisci menthæ piperitæ.
Trochisci morphinæ et ipecacuanhæ.
Trochisci potassii chloratis.
Trochisci sodii bicarbonatis.
Trochisci santonini.
Trochisci zingiberis.
What are confections?
By what other names are these preparations known?
What is the basis of confections?
How many confections are official?
Name them.
How is confection of rose prepared?
How is confection of senna prepared?
How many pill masses are official?
How is mass of copaiba prepared?
If mass of copaiba when made does not readily concrete, what is probably the reason?
How may such a difficulty be obviated?
How is mass of ferrous carbonate prepared?
What preparation of iron does the finished mass contain?
What chemical reaction takes place between ingredients of the mass?
Mass of mercury—Give the Latin official name. Give the synonyme.
How is it prepared? What proportion does the mercury bear to the mass?
How long should the ingredients be triturated?

Pilulæ. *Pills.*

Pills are small, solid bodies, of a globular, ovoid, or lenticular shape, which are intended to be swallowed and thereby produce medicinal action. Pills are more largely used than any other form of solid preparations: substances which are bitter or unpleasant to the taste, if not corrosive or deliquescent, can be administered in this form if the dose is not too large. The ease and rapidity with which pills can be administered, the length of time during which they retain their original activity, their compact form, and their absence of unpleasant taste when coated, are the principal reasons for their extended use.

In order to give medicinal substances the requisite shape and consistence to form pills, they must be brought into a soft condition and made into a mass, generally through the use of a volatile liquid: the subsequent evaporation of this liquid, or a portion of it, should produce but little change in the form of the pill. As previously stated (page 1210), pill masses are sometimes kept in bulk and made into pills when occasion requires: by far the greatest number, however, are made extemporaneously, and the exercise of the knowledge and perception which are necessary in selecting the proper substance to form the mass constitutes one of the most important duties of the pharmacist. To be able always to select the proper excipient requires a thorough knowledge of the physical properties of all the articles of the materia medica which enter into the composition of pill masses.

Forming the Mass.—The mass consists of two parts: 1. The active ingredients. 2. The excipient, or the substance used to form the mass and give it the proper consistence. The essential requirements of a pill mass are that it shall be—1, *adhesive;* 2, *firm;* and, 3, *plastic.*

1. **The mass must be sufficiently adhesive** to retain its shape and yet be soft enough to be worked by the fingers or suitable apparatus into the desired form: to enable it to possess adhesiveness, a liquid is usually added to the powdered ingredients, and the selection of this liquid must always depend upon the physical character of the ingredients; in many cases the latter possess sufficient adhesiveness in themselves if they are moistened with water, and hence the quality is *only developed,*—not created, as in the case of powders containing extracts; others, again, are totally devoid of adhesiveness, and sticky substances, like gum, sugar, etc., must be added in sufficient quantity to supply the deficiency. Some substances may be made soft and adhesive by simply heating them, and they regain their original condition when allowed to cool.

2. **The mass must possess sufficient firmness** to permit the pills to retain their shape. The condition of adhesiveness is usually dependent upon the addition of a liquid which dissolves *a small portion* of the solid ingredients, and this solution is adhesive enough to enable the mass to be made; but if too much liquid be added, the quality of firmness will be lost, and the pills either cannot be formed at all, or will subsequently run together in the box. The physical properties of the active ingredients of the pill must be thoroughly understood to

judge of the proper quantity of excipient to be used to give adhesiveness without losing firmness. The following general rule may serve to guide the operator: *Never use an excipient alone which is a perfect solvent for the solid substances:* for instance, water should not be used *alone* for making pills of the *soluble* scaled-iron salts; for, although the pills may apparently be firm enough when dispensed, they will be very apt in warm weather to run together in the box: if sufficient acacia be used with the water, they can be made to retain their shape.

3. **The mass must be plastic.**—The condition of plasticity is a natural result of the possession of a proper degree of adhesiveness and firmness: many substances may be formed into a mass which will be either adhesive or firm, but unless these conditions are properly balanced, so that the mass can be quickly and easily formed into pills which will retain their shape without flattening, pills cannot be made successfully. Plasticity can generally be secured by thoroughly working or kneading the mass: in this connection see Fig. 383. The choice of the excipient is usually left entirely to the pharmacist, and in making the selection care should be taken that, whilst the pharmaceutical requisites are fulfilled, the proper solubility or disintegrability of the pill in the stomach is not lost sight of.

Choice of the Excipient.—An examination of the following list of excipients will probably convey a good idea of their uses: they are divided into two classes, liquid and solid. Liquid excipients are generally preferred, because they are more conveniently added to the powders.

List of Excipients.

Liquid.

Water.	Used only when the ingredients of the pill possess sufficient adhesiveness to be developed by the water.
Syrup.	An excellent excipient when more adhesiveness is needed than can be afforded by the use of water.
Syrup of Acacia.	Better than syrup, because it is more adhesive, and can be used in smaller quantity. The objection to its use is that the pills made with it are apt to become very hard, and in some cases they may be practically insoluble in the liquids of the stomach.
Mucilage of Acacia.	More adhesive than any of the preceding, but open to the same objection as syrup of acacia.
Glycerin.	Somewhat adhesive, but very valuable, because its hygroscopic properties prevent the pills made with it from becoming hard. It is rarely advisable to use it alone, however, as the surfaces of the pills often acquire a dampness which attracts the particles of dusting-powder.
Glucose.	A very valuable excipient: it is colorless, very adhesive, and practically non-volatile at ordinary temperatures.
Honey.	May be used in place of glucose for dark-colored masses, but quinine pills are not white when honey is used as the excipient.
Extract of Malt.	Has the advantages of glucose, but the disadvantage of honey in not being colorless.
Glycerite of Starch.	Possesses the merits of glycerin, with the adhesiveness of the starch jelly. Its thick consistence is sometimes an inconvenience (see page 319).
Glycerite of Tragacanth.	Similar to glycerite of starch.
General Excipient.	Suggested by the author as combining the advantages of several of the above (see page 1216).

Solid.

Confection of Rose.	Useful when a small quantity of an active ingredient is to be made into pills and dilution is necessary, as in pills of strychnine, podophyllin, etc. Its bulkiness is its principal disadvantage for general work.

List of Excipients.—*Continued.*

Crumb of Bread.	Valuable for very powerful liquids, like croton oil, volatile oils, etc.
Powdered Althæa.	Gives adhesiveness, and is useful as an absorbent, but is bulky.
Soap.	A very valuable excipient for resinous substances. It increases their solubility, and forms an unexceptionable mass.
Resin Cerate.	Valuable for oxidisable substances, resins, etc.
Cacao Butter.	Used for pills of potassium permanganate and similar substances.
Petrolatum.	Used for oxidizable substances like the two preceding excipients.

General Excipient for Pills.

The following excipient is recommended as possessing several advantages. It is a colorless, permanent, very adhesive liquid; the pills made with it are small; and the proportion of glycerin is not large enough to make the surfaces of the pills hygroscopic in an ordinary atmosphere:

Glucose (white, pure)	4 oz. av.
Glycerin	1 oz. av.
Acacia (powdered, best)	90 grains.
Benzoic Acid	1 grain.

Dissolve the Benzoic Acid in the Glycerin contained in a small tared capsule, add the Acacia with stirring, and then the Glucose, and allow the mixture to stand until the Acacia is dissolved: a *moderate* heat may be applied to hasten solution. The benzoic acid is used as an antiseptic; if the excipient is made in small quantities and frequently, it may be omitted.

FIG. 557.

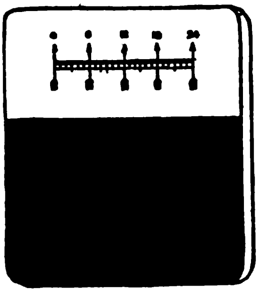
Excipient-bottle.

In Fig. 557 a simple but effective excipient-bottle is shown: it is made from a plain morphine bottle, C; a piece of sheet-rubber cloth, such as is used for making washers, is cut into a disk, R, slightly larger in diameter than the mouth of the bottle; a hole in the centre permits the introduction of a round, slightly tapering wooden rod, H, or, if preferred, a solid glass rod: it is obvious that as the excipient is used the rod may be slipped down so as always to dip into the excipient a certain distance, and thus the quantity adhering to the end can be easily adjusted. One of the merits of this simple device is that all parts of it can be easily renewed and kept clean.

Dividing the Mass.—Upon the small scale the pill-tile may be used for this operation (see Fig. 558): this is usually made of queen's-ware or porcelain. The objection to this material, however, is that some substances will penetrate through the little fissures in the tile and soil it: these are often very difficult to dislodge, and they usually give the tile a dirty appearance, in spite of the most diligent washing. A few years since, Whitall, Tatum & Co. made, at the author's suggestion, a pill-tile from plate-glass, having the scale graduated by an engraver's wheel, and a little over one-half of its surface ground so

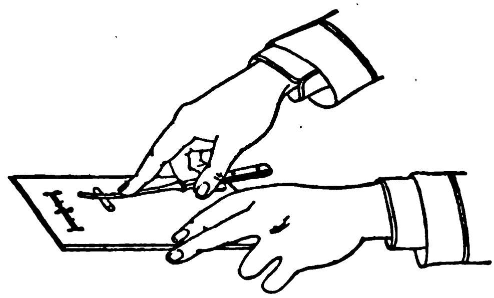
that the pill-cylinder would not slip: this makes an unexceptionable surface. The pill mass is placed upon the tile and rolled into a cylinder, either with a smooth, flat board or a spatula, as shown in Fig. 559: it

FIG. 558.



Pill-tile.

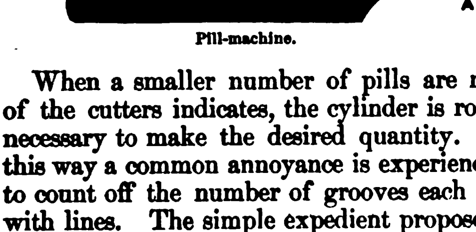
FIG. 559.



Rolling a pill-cylinder.

is then placed upon the graduated scale and cut with the spatula into the desired number of pieces. The pill-machine is preferred in making larger quantities of pills; indeed, many pharmacists never use a pill-tile, but divide and cut all their pills with a machine: this consists of two hard-wood boards, one of which is encased in a metal frame (to prevent warping); a brass plate having hemispherical grooves is fastened to one end of the lower board (B), and a similar plate is adjusted to the upper board (A), which is furnished with handles at the end; brass guides are attached to the upper board, to cause the cutting surfaces of the grooves on both boards to correspond (see Fig. 561). The pill mass is rolled into a cylinder and laid upon the grooves of the lower board; the upper board is then applied so that the cutting surfaces correspond with those of the lower board, and, by a slight backward and forward motion with downward pressure, the mass is divided.

FIGS. 560, 561.

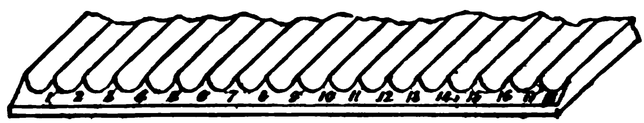


Pill-machine.

When a smaller number of pills are needed than the full capacity of the cutters indicates, the cylinder is rolled out merely to the length necessary to make the desired quantity. In using the pill-machine in this way a common annoyance is experienced, however, in having either to count off the number of grooves each time, or to deface the board with lines. The simple expedient proposed by the author in 1875, and shown in Fig. 562, obviates this. The lower cutter is removed from the board, and its edge is bevelled off so that sufficient space may be gained to stamp a small figure below each cutting edge. Pill-machines with this addition may be had from A. H. Wirz & Son, of Philadelphia. The Cooper pill-machine is so constructed that but one lower

and one upper board are necessary for making several sizes of pills: this object is effected by making the cutters for the various sizes removable and adjustable.

FIG. 562.

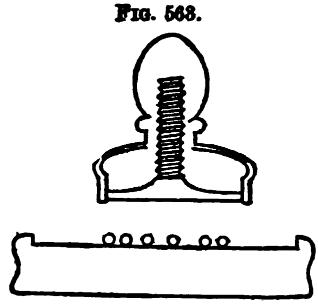


Pill-cutter with numbered edge.

Dusting-Powder.—To prevent the pill-cylinder from sticking to the board or tile, and to lessen the friction, some absorbent powder is dusted upon the surfaces: this may be rice flour, powdered magnesium carbonate, lycopodium, powdered althæa, or powdered liquorice root. Rice flour is preferable for white pills, because its presence is not easily recognized, and because the cylinder does not slip, as it usually does when lycopodium is used.

Finishing the Pills.—Many efforts have been made to supply effective mechanical devices for finishing pills, yet the fact remains that the pharmacist usually prefers to roll and finish them with his fingers. If a finisher is desired, a level surface having a raised rim may be used, and the pills enclosed, and rotated by the adjustable pill-finisher shown in Fig. 563.

FIG. 563.



Pill-finisher.

When large quantities of pills are made, they are usually dried by rolling them in some absorbent powder, spreading them out, and exposing them to dry air.

Dispensing Pills.—Pills are usually dispensed in flat circular boxes: these should be made so shallow that the pills cannot lie on top of one another. Square pill-boxes are coming into use, and are preferred to round boxes for several reasons, the principal one being that a square label can be used: this can be trimmed more neatly and quickly than a round label, and, in the opinion of many pharmacists of taste, looks better. A small quantity of dusting-powder should be placed in the box, to prevent the adhesion of freshly-made pills.

Official Pills.—The following formulas for pills have been adopted by the U. S. Pharmacopœia with the view of securing uniformity in their preparation:

PILULÆ ALOES. *U. S.* Pills of Aloes.

	Metric.	Old form.
Purified Aloes, in fine powder	13 Gm.	200 grains.
Soap, in fine powder	13 Gm.	200 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Water, so as to form a mass, and divide it into 100 pills.

PILULÆ ALOES ET ASAFŒTIDÆ. *U. S.* Pills of Aloes and Asafetida.

	Metric.	Old form.
Purified Aloes, in fine powder	9 Gm.	189 grains.
Asafetida	9 Gm.	189 grains.
Soap, in fine powder	9 Gm.	189 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the solids together with Water, so as to form a mass, and divide it into 100 pills.

PILULÆ ALOES ET FERRI. *U. S.* Pills of Aloes and Iron.

	Metric.	Old form.
Purified Aloes, in fine powder	7 Gm.	108 grains.
Dried Ferrous Sulphate	7 Gm.	108 grains.
Aromatic Powder	7 Gm.	108 grains.
Confection of Rose, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Confection of Rose, so as to form a mass, and divide it into 100 pills.

PILULÆ ALOES ET MASTICHES. *U. S.* Pills of Aloes and Mastic.

	Metric.	Old form.
Purified Aloes, in fine powder	13 Gm.	200 grains.
Mastic, in fine powder	4 Gm.	62 grains.
Red Rose, in fine powder	3 Gm.	46 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Water, so as to form a mass, and divide it into 100 pills.

PILULÆ ALOES ET MYRRHÆ. *U. S.* Pills of Aloes and Myrrh.

	Metric.	Old form.
Purified Aloes, in fine powder	13 Gm.	200 grains.
Myrrh, in fine powder	6 Gm.	93 grains.
Aromatic Powder	4 Gm.	62 grains.
Syrup, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Syrup, so as to form a mass, and divide it into 100 pills.

PILULÆ ANTIMONII COMPOSITÆ. *U. S.* **Compound Pills of Antimony.**
[PLUMMER'S PILLS.]

	Metric.	Old form.
Sulphurated Antimony	4 Gm.	62 grains.
Mild Mercurous Chloride	4 Gm.	62 grains.
Guaiac, in fine powder	8 Gm.	124 grains.
Castor Oil, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Castor Oil, added a few drops at a time, so as to form a mass, and divide it into 100 pills.

PILULÆ ASAFŒTIDÆ. *U. S.* **Pills of Asafetida.**

	Metric.	Old form.
Asafetida	20 Gm.	308 grains.
Soap, in fine powder	6 Gm.	92 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the solids together with Water, so as to form a mass, and divide it into 100 pills.

PILULÆ CATHARTICÆ COMPOSITÆ. *U. S.* **Compound Cathartic Pills.**

	Metric.	Old form.
Compound Extract of Colocynth	80 Gm.	2 oz. av. 360 gr.
Mild Mercurous Chloride	60 Gm.	2 oz. av. 50 gr.
Extract of Jalap	30 Gm.	1 oz. av. 25 gr.
Gamboge, in fine powder	15 Gm.	231 grains.
Water, a sufficient quantity,		
To make one thousand pills	1000	1000

Mix the powders intimately; then gradually incorporate them with the Extract of Jalap and a sufficient quantity of Water to form a mass, to be divided into 1000 pills.

PILULÆ CATHARTICÆ VEGETABILES. *U. S.* **Vegetable Cathartic Pills.**

	Metric.	Old form.
Compound Extract of Colocynth	60 Gm.	2 oz. av. 50 gr.
Extract of Hyoscyamus	30 Gm.	1 oz. av. 25 gr.
Extract of Jalap	30 Gm.	1 oz, av. 25 gr.
Extract of Leptandra	15 Gm.	231 grains.
Resin of Podophyllum	15 Gm.	231 grains.
Oil of Peppermint	8 C.c.	130 minims.
Water, a sufficient quantity,		
To make one thousand pills	1000	1000

Mix the Compound Extract of Colocynth intimately with the Resin of Podophyllum and incorporate the Oil of Peppermint. Rub the Extracts of Hyoscyamus, Jalap, and Leptandra with enough Water to render them plastic, then beat them together with the mixture first prepared, using a sufficient quantity of Water to form a mass, to be divided into 1000 pills.

PILULÆ FERRI CARBONATIS. *U. S.* Pills of Ferrous Carbonate.

[FERRUGINOUS PILLS. CHALYBEATE PILLS. BLAUD'S PILLS.]

	Metric.	Old form.
Ferrous Sulphate, in clear crystals	16 Gm.	247 grains.
Potassium Carbonate	8 Gm.	124 grains.
Sugar	4 Gm.	62 grains.
Tragacanth, in fine powder	1 Gm.	15 grains.
Althæa, in No. 60 powder	1 Gm.	15 grains.
Glycerin,		
Water, each, a sufficient quantity,		
To make one hundred pills	100	100

Rub the Potassium Carbonate, in a mortar, with a sufficient quantity (about 10 drops each) of Glycerin and Water, then add the Ferrous Sulphate and Sugar, previously triturated together to a uniform powder, and beat the mass thoroughly, until it assumes a greenish color. When the reaction appears to have terminated, incorporate the Tragacanth and Althæa, and, if necessary, add a little more Water, so as to obtain a mass of a pilular consistence. Divide this into 100 pills. These pills should be freshly prepared, when wanted.

PILULÆ FERRI IODIDI. *U. S.* Pills of Ferrous Iodide.

	Metric.	Old form.
Reduced Iron	4 Gm.	62 grains.
Iodine	5 Gm.	77 grains.
Glycyrrhiza, in No. 60 powder	4 Gm.	62 grains.
Sugar, in fine powder	4 Gm.	62 grains.
Extract of Glycyrrhiza, in fine powder	1 Gm.	15 grains.
Acacia, in fine powder	1 Gm.	15 grains.
Water,		
Balsam of Tolu,		
Ether, each, a sufficient quantity,		
To make one hundred pills	100	100

To the Reduced Iron, contained in a small mortar, add 6 C.c. [old form 100 minims] of Water, and then, gradually, the Iodine, constantly triturating, until the mixture ceases to have a reddish tint. Then add the remaining powders, previously well mixed together, and mix the whole thoroughly. Transfer the mass to a porcelain capsule,

and evaporate the excess of moisture, on a water-bath, with constant stirring, until the mass has acquired a pilular consistence. Then divide it into 100 pills.

Dissolve 10 Gm. [old form 154 grains] of Balsam of Tolu in 15 C.c. [old form 243 minims] of Ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally rolling them about until the drying is completed. Keep the pills in a well-stoppered bottle.

Pills of Ferrous Iodide should be devoid of the smell of iodine. If a few of the pills be triturated with water, the filtrate should not assume more than a light blue tint on the addition of starch T.S. (absence of more than traces of *free iodine*).

PILULÆ OPII. *U. S.* Pills of Opium.

	Metric.	Old form.
Powdered Opium	6.5 Gm.	100 grains.
Soap, in fine powder	2.0 Gm.	81 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Water, so as to form a mass, an divide it into 100 pills.

PILULÆ PHOSPHORI. *U. S.* Pills of Phosphorus.

	Metric.	Old form.
Phosphorus	0.06 Gm.	1 grain.
Althæa, in No. 60 powder	6.00 Gm.	92 grains.
Acacia, in fine powder	6.00 Gm.	92 grains.
Chloroform,		
Glycerin,		
Water,		
Balsam of Tolu,		
Ether, each, a sufficient quantity,		
To make one hundred pills	100	100

Dissolve the Phosphorus, in a test-tube, in 5 C.c. [old form 81 minims] of Chloroform, with the aid of a very gentle heat, replacing from time to time any of the Chloroform which may be lost by evaporation. Mix the Althæa and Acacia in a mortar, next add the solution of Phosphorus, then immediately afterwards a sufficient quantity (about 4 C.c.) [old form 65 minims] of a mixture of 2 volumes of Glycerin and 1 volume of Water, and quickly form a mass, to be divided into 100 pills.

Dissolve 10 Gm. [old form 154 grains] of Balsam of Tolu in 15 C.c. [old form 243 minims] of Ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them

on a plate to dry, occasionally rolling them about until the drying is completed. Keep the pills in a well-stoppered bottle.

PILULÆ RHEI. *U. S.* Pills of Rhubarb.

	Metric.	Old form.
Rhubarb, in No. 60 powder	20 Gm.	308 grains.
Soap, in fine powder	6 Gm.	92 grains.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Beat the powders together with Water, so as to form a mass, to be divided into 100 pills.

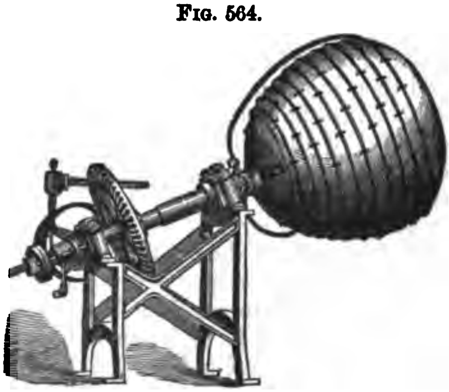
PILULÆ RHEI COMPOSITÆ. *U. S.* Compound Pills of Rhubarb.

	Metric.	Old form.
Rhubarb, in No. 60 powder	13 Gm.	200 grains.
Purified Aloes, in fine powder	10 Gm.	154 grains.
Myrrh, in fine powder	6 Gm.	92 grains.
Oil of Peppermint	0.5 C.c.	8 minims.
Water, a sufficient quantity,		
To make one hundred pills	100	100

Mix the Oil of Peppermint with the powders, then beat the mixture with Water so as to form a mass, to be divided into 100 pills.

Coating Pills.—Pills are coated with sugar, gelatin, silver leaf, gold leaf, or French chalk, with the view of masking their taste. The sugar-coating of pills is carried on upon a very large scale in this country. The pills are carefully dried, placed in a round-bottomed copper pan, a mixture of syrup and starch added, the whole heated, and the pan kept moving constantly, so that a rotary motion is imparted. Whilst evaporation takes place, additions of syrup are made from time to time, so that a crust of sugar gradually forms upon the surface of each pill. Fig. 564 shows the form of pill-coater used by Allaire, Woodward & Co., of Peoria, Illinois. The rotary motion and heating of the copper pan are effected by the use of steam. A polish is given to the pills by agitating them in a bag or rolling them in a shaker in contact with a piece of wax or paraffin.

FIG. 564.

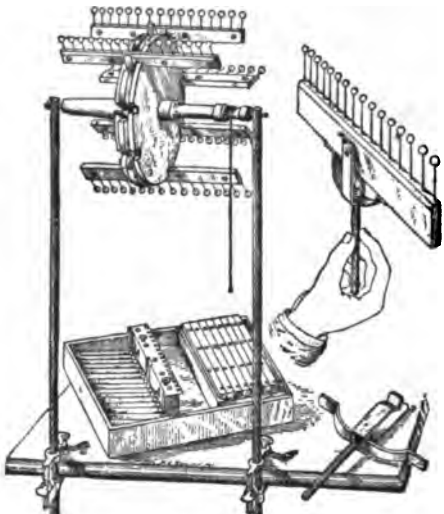


Machine for sugar-coating pills.

Pills cannot be satisfactorily coated with sugar in the small way

without much labor. This is not the case with gelatin coating. It is quite possible for the pharmacist to coat pills with gelatin and be able to dispense them in fifteen minutes. The coating of pills with gelatin is an old process. Formerly each pill was impaled upon a long needle, dipped into a solution of gelatin, and the end of the needle stuck into a cork to permit the coating to dry. This slow process was improved by Chas. B. Allaire, who devised a machine for dipping a number of pills at once, and also one for stripping the needle-bar. Since then many machines have been introduced for coating pills with gelatin, and since the introduction of sugar, gum, or saccharin in small quantities to the gelatin mass their use is likely to increase. Prof. Patch's coater is shown in Fig. 565. The dried pills, which must not be made with glycerin, roll down the inclined grooves, shown in the tray in the drawing, until each of the hemispherical depressions at the end of the groove contains a pill. A wooden strip armed with sixteen needles is inverted over the sixteen pills in the depressions, and the points of the needles are pressed into them until every one is impaled; the adjustable handle is now attached, and the pills are dipped into a hot solution of pure gelatin (page 1058), and then gently twirled until the coating has set, when the strip is transferred to the catch in the wheel. This wheel is made to rotate, first in one direction and then in the opposite, by alternately pulling and relaxing the string attached to the axle : this rapidly dries the coating. The needles are stripped of the pills by engaging them in the comb, as shown in the cut. In Franciscus's pill-coater the needles are set in a brass bar, and the rotation is in a different direction. Other machines are favorably known: in the larger-sized Porcupine pill-coater the revolution of the cylinder to which the needle-bars are attached is effected by clock-work.

FIG. 565.

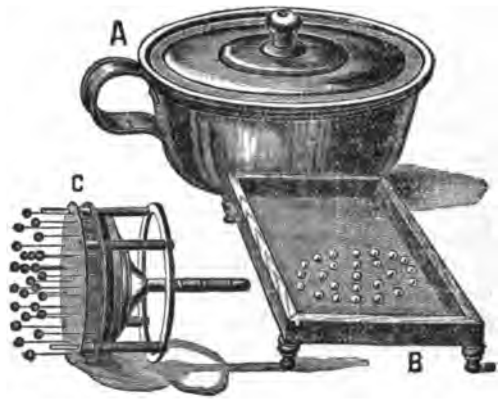


Prof. Patch's gelatin-coater.

Maynard's pill-coater is illustrated by Figs. 566, 567, 568, 569, 570, and 571. It is operated by first placing the flat metallic ring F around the feeding-plate E, and pouring the pills into the cup which is thus formed; the conical indentations in E are filled, and the excess of pills remaining on the top of the plate is permitted to roll off into a box. The dipper or needle-holder D is then placed in position immediately over the pills on the feeding-plate, the guide-pins on the sides securing accuracy in centering the pills with the needle-points; the handle of the needle-holder is then pressed downward until the points of the needles enter the pills nearly to their centres. The pills, after they are im-

paled, as seen at C, are dipped into the melted gelatin solution; the needle-holder is then slowly revolved in the air in order to facilitate the even distribution of the gelatin film on the surface of the pills. When the film becomes thoroughly cold, it should be solid enough to permit the pills to be stripped from the needles. It is well to have two needle-holders, so that whilst the gelatin on the pills on one is solidifying the other may be started on the coating; in this way the process is rendered continuous. When the coating on the pills is sufficiently hard, the pills are stripped from the needles by grasping the circular plate on the needle-holder with one hand and pulling the handle of the needle-holder upward; the pills drop off, and should be deposited on the tray of wire gauze B to dry. The circular plate through which the needles pass should be slightly greased with cosmoline to prevent the pills from adhering to it. The gelatin solution is heated in an agate-ironware dish, set in a copper water-bath having a cover. This arrangement prevents a film from forming on the surface and aids in retaining the uniformity of the gelatin solution. When the pills are not being dipped, the cover should be kept on the dish.

FIGS. 566, 567, 568.



Maynard's pill-coater.

FIGS. 569, 570, 571.

Maynard's pill-coater.

A valuable invention in coating pills with gelatin has been made by J. B. Russell, of Detroit: needles for impaling the pills before dipping have been discarded and the pills are held firmly upon the ends of tubes by suction, the tubes being connected with a box from which the air has been exhausted. A little over one-half of each pill is dipped in the gelatin solution; this is rapidly dried. Subsequently the pill is reversed, and the uncoated portion is then dipped, thus completing the coating. The process is used in the laboratory of Parke, Davis & Co.

Pills may be coated with gelatin by cutting the pill-cylinder to its centre, placing in the cleft a piece of sewing-silk, rolling it, dividing it into pills, dipping in gelatin solution, drying, and cutting apart.

Gelatin-Coating Solution.

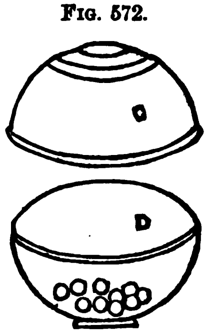
(Prof. Patch.)

Gelatin (French, gold label)	2¼ oz. (av.).
Powdered Boric Acid	120 gr.
Mucilage of Acacia	2 fl. oz.
Distilled Water	7 fl. oz.

Macerate the Gelatin with the Water until it softens, dissolve it by heating in a water-bath, and add the Boric Acid; then slowly add the Mucilage of Acacia, and strain the mixture.

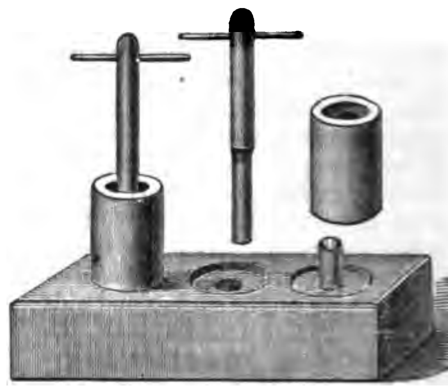
Pills may be coated with gold or silver leaf by first placing a drop of syrup of acacia in a mortar, and, after carefully spreading it over the surface with the end of the finger, dropping in the pills, rotating them so that they shall be uniformly coated with a very thin layer of mucilage, and then dropping them into the gold or silver leaf contained in the coater. This is merely a smooth, globular box, opening in the middle (see Fig. 572). When the pills are rotated, they soon become coated with the leaf, and are then ready to dispense. In the absence of a globular box a large-sized pill-box may be used.

FIG. 572.



Silver-coater.

FIG. 573.



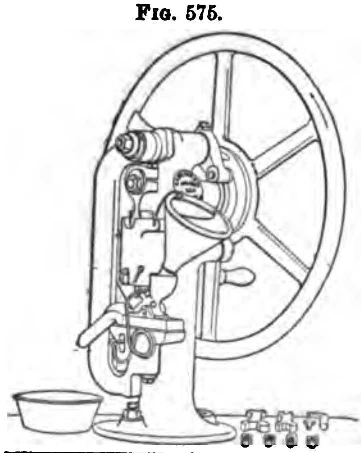
Compressed-pill-machine.

Compressed Pills and Troches are made by subjecting dry powders to a sufficient degree of pressure in suitable machines to cause them to cohere: the pressure may be effected by a blow from a mallet, or by means of a lever or combination of levers. To enable the pharmacist to prepare his own compressed pills the author devised, in 1875, the machine shown in Fig. 573 for making them. It is made of cast steel: the base has two countersunk depressions with a short post in the centre of each; a lenticular depression is made in the upper surface of each post. A steel cylinder having a central aperture of the diameter of the post is placed in the depression, the proper quantity of powder is introduced, and the plunger, which has a corresponding lenticular depression on its lower surface, is placed on the powder and is struck a quick blow with a mallet; the powder is compressed, and the pill adheres to the cylinder; by removing the cylinder and holding it over a box and tapping the plunger again lightly, the pill is forced out, and falls into a

box. Brockedon, of England, was the first manufacturer who introduced this form of pill. In this country, Jacob Dunton, of Philadelphia, was the first to extend the process to a long line of pills, but subsequently John Wyeth & Bro. prepared compressed pills upon an enormous scale.

In one of the compressed-pill-machines in use by this firm a circular steel disk, which is perforated with a number of holes, is made to revolve slowly; at regular intervals its motion is stopped long enough to deposit the proper weight of powder and to permit a plunger having a moulded end, as in Fig. 573, moving from above, almost to meet a similar one rising from below the plate; the powder is caught between the two moulds, is compressed, and the pill finds its way out through the spout into the box below. The advantages of compressed pills are that no excipient is used in their preparation, they are easily disintegrated or dissolved in the liquids of the stomach, and their lenticular shape is favorable to their being easily swallowed. Machines for making compressed pills and troches which are adapted for either hand- or steam-power are now made extensively. Fig. 575 shows the Crown tablet machine, made by H. K. Mulford & Co, of Philadelphia. The material which is to be compressed is fed into the funnel; in the lower part of this funnel there is a sieve, to prevent large lumps from passing through and clogging the feeder. By means of simple yet ingenious mechanism the powder finds its way to the die-plate, the feeder being shaken constantly in order to keep the powder in motion, so that uniformity in feeding is secured while it is being delivered. When the chamber in the die-plate has received its charge, the feeder moves out of the way to make room for the compressor, which then forms the tablet in the die; the ejector follows the compressor after it has moved out of the die-plate, and the tablet is knocked off and into the pan underneath by the feeder. The same motions are repeated continuously. When everything is in order and the machine is properly operated, compressed tablets may be made very rapidly. The weight of the tablet may be adjusted with simplicity and accuracy.

FIG. 575.

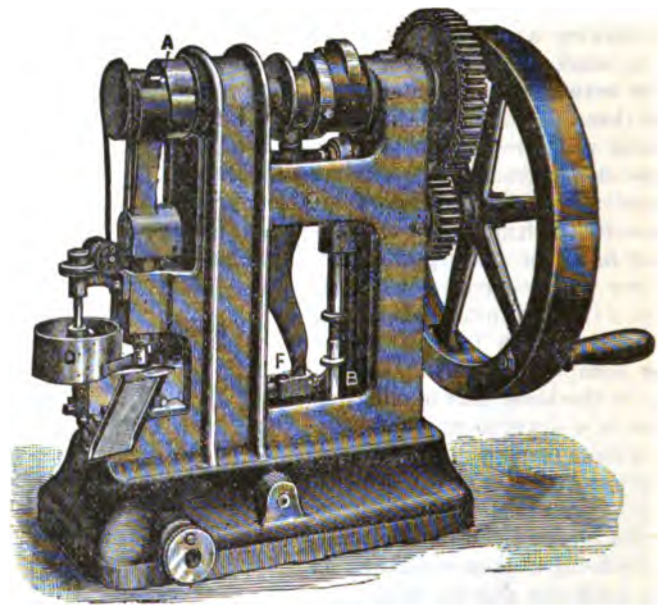


Crown tablet machine.

Fig. 576 represents the McFerran machine for compressing powders. The plate which carries the die is reciprocating, and the dies are capable of being changed quickly when tablets of different sizes are to be made. The feed-cup D has a stirrer in it, and the material is thus kept in uniform motion while the machine is in operation. The weight of the tablet is adjusted by turning the side screw. The pressure is regulated by a worm wheel, A, on the crank pin, and it is possible to make tablets which are hard or fragile at will. One of the advantages of this

machine is the comparative absence of noise in running it. With practice an operator can make from forty to sixty tablets in a minute. In making compressed pills and lozenges it must not be supposed that the various powders which are to be compressed need no previous treatment. Both experience and knowledge are necessary to always achieve

FIG. 576.



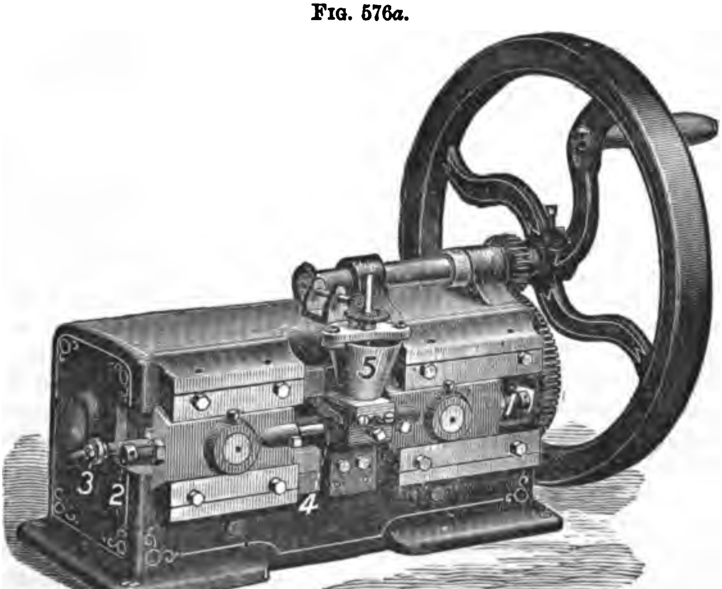
McFerran compressed-tablet machine.

success. Some powders are too dry, and need moisture before they can be compressed; others are too damp, and need drying; others have so little cohesive property that even the application of a powerful press is insufficient to keep them from splitting or breaking; others again possess too great a tendency to adhere to anything that they come in contact with. The manufacture of compressed pills and powders has developed a special knowledge of the properties of medicinal substances which is very valuable to those who operate these machines largely. A few illustrations of the methods used for overcoming the difficulties alluded to will be appended. Tablets of potassium chlorate are made without trouble, the slightly moist, finely granulated salt being preferred, because it will feed more regularly than that which is in fine powder. Sodium bicarbonate is compressed very frequently, and it is used in making the so-called soda-mint tablets; its powers of cohesion are not good, but if five per cent. of powdered acacia be added and the whole moistened with water, sifted through a coarse sieve, and dried, there will be no difficulty. The oil of peppermint should be added after it is dried, from one to one and a half per cent. being the usual quantity. Powders which consist mainly of sugar of milk need damp-

ening with a mixture of one part of simple syrup and two parts of water. The damp powder should be sifted through a coarse sieve and dried; just before compression a little powdered talcum is often sifted in to prevent the tablet from adhering to the die. White cosmoline or vaseline in small quantity is sometimes incorporated with a dry powder to facilitate compression and improve the appearance of the pill or lozenge. Two per cent. of cosmoline dissolved in sufficient ether to permit of its thorough diffusion through the powder is sufficient. Of course the powder should be sifted and dried. When troches or pills are to be made of such dry and apparently incompressible powders as quinine sulphate, charcoal, salicylic acid, or sodium salicylate, compression can be accomplished by moistening the powder with a solution of gelatin, sifting, drying, and using a little talcum. If a trace of the ethereal solution of cosmoline or finely powdered arrowroot is added to the quinine sulphate, instead of the talcum, the pills will disintegrate more readily, but pills of quinine bisulphate are more easily made and are more soluble. Very frequently the dampening of the powder with a little ether or alcohol is all that is necessary to secure compression. On the large scale it may be found more advantageous to replace acacia with white dextrin. Hypodermic tablets may be made with a base of purified sugar of milk; although perfectly neutral dried sodium sulphate and purified sodium chloride are probably better.

A number of compressed pill machines have been placed upon the market within a few years. Robert Shoemaker, Jr., of Philadel-

FIG. 576*a*.



Witzel tablet machine.

phia, manufactures machines of various sizes of excellent workmanship; these are well adapted for use with steam-power. The Jordan

Tablet Machine (made in Tacony, Pa.) and the Keystone Tablet Machine (A. Leggoe & Co., Philadelphia), are machines largely used by pharmacists for making tablets when hand-power is available. The Witzel Machine (Tacony, Pa.) differs so radically in its mechanical construction from the others that an illustration is appended to show its peculiarities. Instead of the dies being operated in a perpendicular position, they are arranged horizontally, the compressing chamber (4) is immediately under the immovable hopper (5), and the powder easily enters by its own gravity; after the tablet is formed, a mechanical finger pushes it off the die into the box. The frame is one solid casting, occupying a counter space of 10 by 17 inches. The capacity can be increased by adding plungers. The pressure is easily regulated, and is imparted by cams to the sliding-blocks. Ample provision is made for taking up lost motion due to the wear of the moving parts. The dies and moulds can be readily changed from one size to another, and the adjustments, being few and simple in construction, are easily understood and quickly manipulated. Tablets are formed by the following motions: When the plungers are below the hopper they receive the proper amount of material, which is conveyed under cover to the mould; one plunger is held stationary while the other advances and compresses the material, then both dies recede, thus loosening the tablet, which is then ejected. The machine is well adapted for pharmacists' use.

GELATIN CAPSULES AND PEARLS.

The gelatin-coated pill is not the only form in which nauseous or bitter medicines may be administered with their taste concealed, gelatin capsules having been in use for many years.

Gelatin Capsules are of three kinds, designated as hard, soft, and empty: the first two are used in administering liquids. Empty capsules may be used for liquids, but they are generally employed in concealing the taste of bitter solids. The principle upon which they are all made is that of dipping a smooth mould, usually of bone or ivory, into a thick, hot solution of gelatin, allowing the film to become cold, removing it at the proper time, filling it with the liquid, and then sealing it.

Figs. 578, 579, 580, 581, and 582 show the apparatus used by Parke, Davis & Co., and illustrate the method of making and filling capsules. The process is not new, and the theory is simple, but success in making capsules is not apt to crown the first efforts, considerable experience being necessary.

The material employed for the shells or envelopes of soft elastic capsules is a composition of gelatin and glycerin, the proportions being varied according as a softer or a harder capsule is desired. A sufficient quantity of water is employed in making the composition to produce a fluid which shall be of the proper consistency. No exact formula can be strictly adhered to, because the proportion will vary with different samples of gelatin; but after a little experience the operator learns to adjust it to a nicety. The composition must be kept at a uniform tem-

perature—about 40° C. (104° F.) by means of a water-bath. A wooden mould, having a stem about four inches in length (see Fig. 578), is employed for forming the shell. A number of these moulds are fixed in the perforated wooden disks shown in Fig. 581, and when in use these disks are supported on a simple frame or rack, consisting of two parallel strips of wood about four inches apart (see Fig. 580). The moulds must be slightly oiled, to prevent the composition from

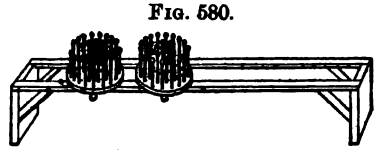
FIG. 578.

Capsule-mould.

FIG. 579.

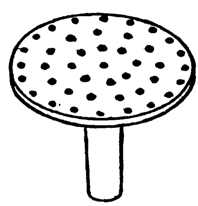
Shell-supporter.

FIG. 580.



Capsule-holder rack.

FIG. 581.



Capsule-mould holder.

FIG. 582.

Capsule-syringe.

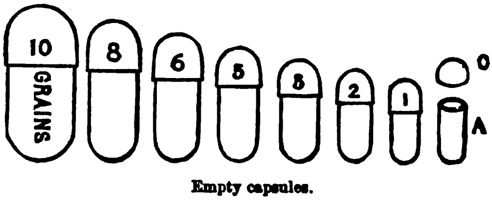
adhering to them; but excess of oil must be avoided, or they will refuse to take the gelatin. All being now in readiness, the operator takes one of the disks from the rack by its handle, inverts it, and dips the mould carefully into the gelatin composition, then withdraws it slowly with a steady motion, so as not to take up more of the fluid than is required. The moulds are now held in a current of cold air, produced by a fan or other suitable device, being kept in constant motion by the operator to secure an even distribution of the gelatin until it is sufficiently congealed, when the disk is returned to its place, and the operation is repeated with a second disk. The disks are allowed to remain a few minutes on the rack, until the gelatin is hard enough to be handled without sticking to the fingers. They are then taken to a table, and by a smart rap with the hand (the disk being held in a vertical position) the moulds are shaken out of their sockets. An operator provided with an ivory knife next separates the capsule from the superfluous gelatin which has adhered to the stem of the mould, and the soft, elastic shell is then pulled from the mould and placed in an upright position for filling upon the shell-supporter (see Fig. 579). This operation of stripping off the capsules can be best performed by the delicate fingers of a young girl, since any

roughness in the cuticle of the operator will leave its impression indelibly upon the soft gelatin.

The capsules are filled by the skilful use of the syringe (see Fig. 582), great care being taken that none of the oil be allowed to touch the edge of the capsule, since such an accident would render it impossible to seal the capsule. The final operation of sealing is accomplished by passing over the opening a small stick charged with the gelatin composition of which the capsule is made. When the capsules are thus finished, they are allowed to stand a few hours on the supporters to dry, and are then spread out on a sheet of white paper in order to detect any that may be imperfectly sealed. These having been removed, the capsules are ready to be packed in boxes for the market. The hard capsules differ from the elastic ones only in the omission of glycerin from the composition of the envelopes, the manipulation being the same, except that it is necessary to allow the finished capsules to remain several days on the supporters to become completely dry and hard before they are packed.

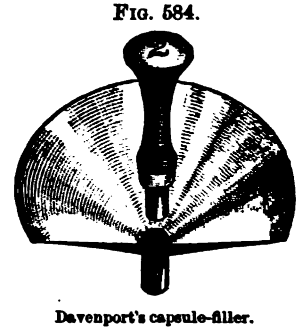
Empty capsules are not ovoid in shape, but cylindrical (see Fig. 583). They are made of several sizes, and are usually designated by numbers. The smallest size in the illustration is represented with the cap, C, off: these are used by pharmacists for enclosing nauseous or bitter powders or masses. They are filled in several ways: one plan is to make a mass of the powders, divide it into little rolls, as in making pills, insert them in the larger end of the capsule, A, and place the cap, C, tightly upon it. To fill the capsules with powders several devices are employed. Whitfield's capsule-filler is the most elaborate apparatus. Davenport's method is very simple: the filler is shown in Fig. 584. It consists of a funnel, tube, and plunger. The funnel is flattened at one side, to assist in taking up the material, the tube attached to the funnel is of the proper size to be placed in the capsule, and its end is cut off at an angle to permit its ready application in the capsule. The funnel and tube are made from one piece of metal, without seam or joints. The plunger is of hard wood, and of the proper size for entering the tube. It is supplied with a rubber collar, which admits of the piston's being pressed entirely through the tube to eject the material. Each filler and plunger is numbered to correspond with the number of the capsule. In use, the material is first divided into powders; the capsule is placed on the tube, the flat edge of the funnel held nearest to the operator, and the powder scraped into the funnel; the filler is held in an upright position, and the plunger raised; after the powder has

FIG. 583.



Empty capsules.

FIG. 584.



Davenport's capsule-filler.

passed into the tube, the plunger is inserted, the capsule held firmly on the tube, and pressure applied to the plunger, forcing the powder into the capsule, which is then removed and capped in the usual manner.

Reymond's capsule-filler (see Figs. 585 and 586) consists of two blocks of hard wood. In the lower one in Fig. 585, C, twelve sockets are bored of sufficient depth to enable the capsules to be inserted one-half of their length: these sockets are so shaped at the bottom as to correspond with the lower end of the capsule. A small hole is bored through the bottom of each socket. The upper side of the upper block, B, is provided with twelve funnel-shaped receptacles of sufficient capacity to hold all the powder intended to fill the capsule, the lower end of these receptacles being so shaped that when the two sections are in proper position for use they will project just over the upper edge of the capsule. The under side of this section is provided with twelve holes a trifle larger than those in C, and of sufficient length to cover that portion of the capsule projecting above C. Pegs are inserted in either section to fit into corresponding holes in the other, so as to hold the two together in proper position when the filler is in use (see Fig. 586). A tampon, A, is provided with which to pack the capsule.

FIG. 585.

FIG. 586.

Reymond's capsule-filler.

Suppositoria. *Suppositories.*

Suppositories are solid bodies intended to be introduced into the rectum, urethra, or vagina to produce medicinal action. Their form is usually conical, with a rounded apex, and their consistence should be such that, whilst they will retain their shape at ordinary temperatures, they will readily melt or soften at the temperature of the body. Oleum theobromæ, or cacao butter, is the best base for suppositories, because it accurately fulfils both of the above requirements: it was first suggested in this connection in 1852, by Mr. Alfred B. Taylor, of Philadelphia. It is rarely necessary to raise the melting point of cacao butter by the addition of wax, spermaceti, etc., except in the warmest summer weather, or when carbolic acid, camphor, chloral, the volatile oils, or similar substances form the medicating ingredients. Gelatin suppositories are made from a mass containing gelatin and glycerin, by soaking gelatin in water, draining off the excess, adding five parts by weight of glycerin to every twelve parts of soft gelatin, and heating in a water-bath. The medicating substance is rubbed into a smooth paste with a small quantity of water or glycerin and added to the mass. Since the extended use of suppositories the size has been gradually reduced, until fifteen-grain suppositories are now most largely employed. Suppositories are usually of three kinds: 1. Rolled; 2. Moulded; 3. Pressed.

1. **Rolled Suppositories** are made by a very simple method: the cacao butter is scraped or grated and placed in a mortar; the medicating ingredients are reduced to powder, or, if composed of extracts, are softened with water and rubbed until a smooth paste is formed; a mass resembling a pill mass is now made by thoroughly incorporating the ingredients with a pestle, and, having thoroughly dusted a pill-tile with lycopodium, a suppository cylinder is formed by rolling the mass upon the tile with a spatula, after having softened it by partly shaping it with the fingers: if the mass is brittle, it may be softened by thoroughly incorporating a few drops of olive oil with it; the cylinder is rolled out and then cut into the proper number of pieces with a spatula; the conical shape is given by rolling *one end* upon the tile with a spatula, so as to produce a rounded point. In warm weather it is necessary to use lycopodium, powdered elm bark, or a similar absorbent powder freely. With practice, excellent rolled suppositories can be made. This method has the substantial merit of requiring very little apparatus, but considerable skill is needed to produce suppositories equalling in finish those which are moulded. Fig. 587 and Fig. 588 show two views of Bing's apparatus for shaping rolled suppositories. The suppository cylinder is placed upon the base-plate and well dusted with lycopodium; it will be observed that the plate has the shape of one-half of a suppository divided longitudinally; upon moving the upper plate backward and forward on the suppository cylinder, gradually increasing the pressure, the suppository assumes the conical form. Three base-plates, for three different sizes of suppositories, are shown.

FIG. 587.

Bing's suppository-machine.

FIG. 588.

End-view of the same.

2. **Moulded Suppositories** are more largely used than any other kind; preference is given to them in the official directions, although the other kinds are permitted: the directions are as follows:

Mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of Oil of Theobroma, by rubbing them together, and add the mixture to the remainder of the Oil of Theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable moulds. The moulds must be kept cold by being placed on ice, or by immersion in ice-cold water; and the inner surface of the moulds should be carefully freed from adhering moisture, before the melted mass is poured in. In the absence of suitable moulds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing into parts of a definite weight each, which may be made into a conical or other convenient form for a suppository. Unless otherwise specified, suppositories should have the following weights and shapes, corresponding to their several uses: *Rectal Sup-*

positories should be cone-shaped, and of a weight of about one gramme (15 grains). *Urethral Suppositories* should be pencil-shaped, and of a weight of about one gramme (15 grains). *Vaginal Suppositories* should be globular, and of a weight of about three grammes (46 grains).

The only official suppositories are those made with glycerin: the process for these was perfected by the author (Proc. A. P. A. 1892, p. 267). They are preferably dispensed by inserting each in a glass tube with a cork at each end.

SUPPOSITORIA GLYCERINI. *U. S.* **Suppositories of Glycerin.**

	Metric.	Old form.
Glycerin	60 Gm.	2 oz. av. 50 gr.
Sodium Carbonate	3 Gm.	46 grains.
Stearic Acid	5 Gm.	46 grains.
To make 10 rectal suppositories.		10 suppositories.

Dissolve the Sodium Carbonate in the Glycerin in a capsule on a water-bath; then add the Stearic Acid, and heat carefully until this is dissolved, and the escape of carbonic acid gas has ceased. Then pour the melted mass into suitable moulds, remove the suppositories when they are cold, and wrap each in tin-foil. These suppositories should be freshly prepared when required.

The principle upon which suppositories are moulded depends upon the fact that the mass after being introduced into the moulds contracts upon cooling; when the limit of contraction is reached, the suppository is a trifle smaller than the mould in which it has been made, and it can be easily extracted: hence the importance of allowing the moulds to become thoroughly cold after the introduction of the melted mass. The novice almost invariably makes the mistake of opening the divided moulds too soon (before the limit of contraction is reached): the suppository sticks to the mould, and splitting ensues. The difficulties encountered in making moulded suppositories generally arise from the use of too much heat in melting the mass. A suppository mass containing an extract bears some analogy to an emulsion, with the proportions of the ingredients reversed: the fatty substance here is in great excess; the extractive matter is the substance to be uniformly suspended, whilst the water is relied upon to effect this object: this can be done by making the extract into a soft paste with the water, and gradually incorporating it with the partly-melted cacao butter by stirring.

Other difficulties in moulding suppositories are easily overcome by the exercise of judgment and knowledge of physical laws. A defect frequently seen in the finished cacao butter suppository is that the surface is not always perfectly smooth. This may arise from several causes. Sometimes ridges are seen traversing the suppository; these are usually produced by overcautiousness, the operator pausing in pouring the melted mass into the mould, then pouring in a little more, then pausing again, and so on: on taking out the suppository, a ridge will be found at each spot where a pause was made. The remedy for this

is to keep on pouring steadily when this part of the process is reached. Other defects are pitting and an imperfection in the formation of the summits of the suppositories. The pitting is caused by drops of water which have been allowed to remain upon the sides of the mould; the imperfect summits are due to water which has not been shaken out of the mould before pouring in the melted mass. Still another defect is a conical hole in the centre of the base of each suppository. This is due to not overflowing the moulds so as to leave an excess of mass upon the top. In all cases there should be a little more mass than will fill the moulds, and after cooling the excess can be cut off.

If *strong heat is used*, the water is evaporated, the extract separates in small masses, and, like a bad emulsion, the mass is "cracked." The remedy is to pour it at once upon an ointment slab or tile, add a little water, and rub it until the original condition is regained.

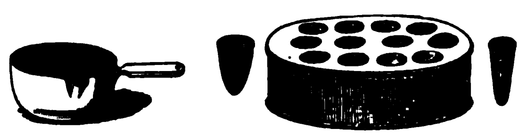
FIG. 588*a*.

Wellcome's suppository.

Henry S. Wellcome, of London, has devised an improvement in the shape of the moulded suppository which prevents the expulsion of the suppository after insertion; this consists in tapering the suppository at the base, and from there gradually expanding its width until near the top, which terminates in a blunt point. (See Fig. 588*a*.)

Pouring the Mass.—The mass should be poured into the mould from a dipper held in the right hand, a vigorous stirring being maintained with a spatula held in the left hand immediately before the pouring begins; indeed, when heavy powders are directed, the stirring must not cease during the pouring, or the last suppositories will contain a larger proportion of the heavy powder than those which were first made. A porcelain casserole (see Fig. 589) is the best vessel to melt the mass in; and it is much better to dip it into a dish containing hot water than to use direct heat. The use of lycopodium to dust the inside of the moulds is unnecessary. If proper attention be given to cooling the moulds thoroughly, there will be no difficulty from the adhesion of the suppositories.

FIG. 589. FIG. 590. FIG. 591. FIG. 592.



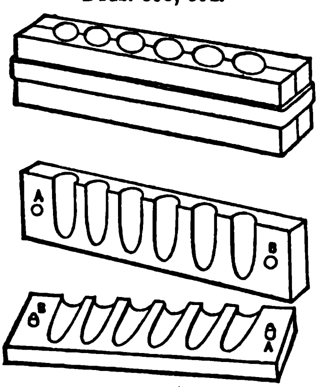
Casserole. Individual suppository-moulds.

Suppository-Moulds.—Many forms are in use. They may be arranged in three classes: 1. Individual moulds. 2. Divided moulds. 3. Hinged moulds.

1. **Individual Moulds** are those which were first employed: in this form an oval metallic dish is furnished with a lid which contains twelve circular perforations (see Fig. 591) for supporting twelve individual moulds made of white metal. To prevent the moulds from slipping through when they are placed in the perforations, they each have a shoulder, which rests upon the lid (see Fig. 590 and Fig. 592). The dish is nearly filled with chopped ice or snow, the lid supporting the moulds is placed in position, and the melted mass is

poured in. After the suppositories have become thoroughly cold, they are removed by inverting the mould and tapping it lightly on a hard surface, when they usually drop out. They sometimes fail, however, to answer the summons promptly. This is generally due to the mould's not being perfectly clean. The difficulty of quickly and easily cleaning these small moulds, and the liability of losing or misplacing them, constitute the most serious drawbacks to the use of this form.

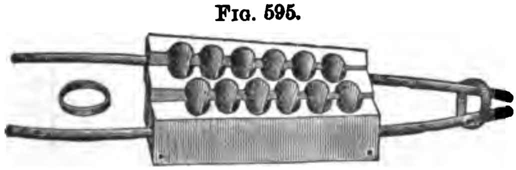
FIGS. 593, 594.



Divided suppository-mould.

Divided Moulds.—This, at present, is a favorite kind of suppository-mould, one of the advantages being the facility with which it can be cleaned. They are preferably cooled by placing them upon a piece of ice. The simplest form is shown in Fig. 593. The upper mould is represented as closed and ready for use, being held together by an ordinary rubber band. The open mould is shown below. It is made of brass, and consists of two parts, which are kept in position by placing the pins A and B in their respective sockets. This form is seen enlarged in the Wirz mould (see Fig. 595). This mould will make twelve suppositories at one time, and it is held together by two brass rings which are slipped over the handles. The circular forms have the very great advantages of requiring but a small piece of ice and of being almost indestructible. Figs. 596 and 597 show See's mould: the central core is held in position by a set-screw. Fig. 596 represents the closed mould, and Fig. 597 shows the core when elevated. This mould is made by J. M. Maris & Co., of Philadelphia. The best divided mould is unquestionably that shown in Fig. 598. It was manufactured by L. R.

FIG. 595.



Wirz's suppository-mould.

FIG. 596.

See's mould (closed).

FIG. 597.

See's mould (open).

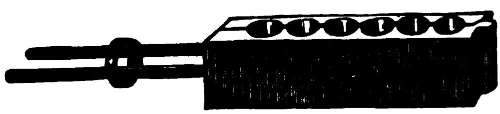
FIG. 598.

Blackman's suppository-mould.

Blackman, of Newport, R.I. The division of this mould is horizontal instead of perpendicular. It is made of gun-metal, is nickel-plated, contains no small working parts, and is compact and simple in its construction. The relative position of the upper and lower parts is shown in the illustration. When the suppositories have contracted sufficiently to leave the mould easily, it may be known by pressing one of them slightly upon the top. If it can be moved downward slightly, it indicates that they are loose, when the upper part, carrying the suppositories, may be separated by lifting it from the lower part; it is then inverted over a piece of paper, when a light tap will cause the suppositories to drop out.

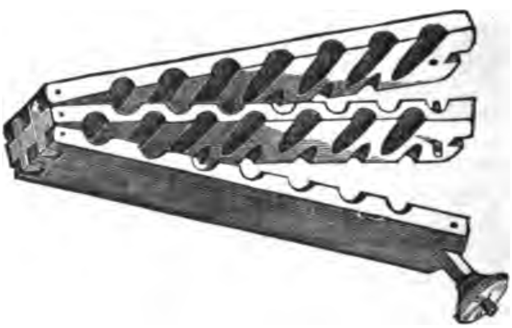
Hinged Moulds.—This form differs from the divided moulds in being connected with a hinge. They are used in the same way as the divided moulds. One of the simplest forms is seen in Fig. 599. This

FIG. 599.



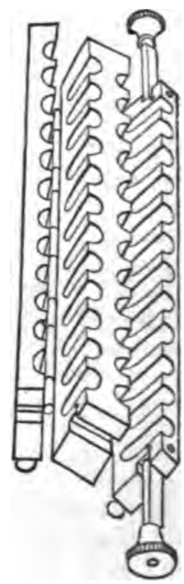
Hinged mould.

FIG. 600.



Benton, Myers & Co.'s suppository-mould.

FIG. 601.



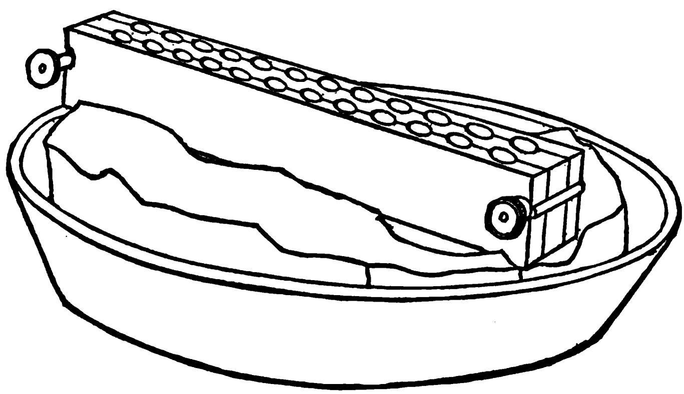
English suppository-mould.

opens perpendicularly, and is closed in the same way as the mould shown in Fig. 595. Benton, Myers & Co.'s mould (Fig. 600) is constructed so that two different sizes of suppositories may be made in it. It is in addition a double mould, is hinged at one end, and closed by a screw-catch at the other. Figs. 601 and 602 are illustrations of a very serviceable English mould, recommended by Mr. Henry B. Brady, of Newcastle-on-Tyne. It differs from all others in being hinged at the bottom. It is held together by two screw-catches, one at each end. Fig. 602 shows this mould closed, and in position upon a cake of ice.

Compressed Suppositories.—The method of making suppositories by compression has been used to some extent, but the expense of the apparatus required in their production constitutes a serious drawback.

A. M. Knowlson, of Troy, N.Y., is the maker of an effective suppository-machine, which presses the mass through a cylinder into a

FIG. 602.



Suppository-mould on ice.

mould, and finally discharges the well-finished suppository, without the use of any heat whatever. Efforts are now being made to perfect a simple, effective, and cheap machine upon this principle. In Archibald's suppository-machine the compression is effected by a lever working perpendicularly in a cylinder containing the suppository mass. This apparatus is shown in Fig. 603. The suppository mass may be made in the usual way (see page 1123), or the medicating ingredient, if in powder, may be mixed with the grated cacao butter and thoroughly distributed through it. The proper mould (7) having been introduced in the swing-bed (4), the latter is moved accurately into position under the hopper (3), and the plunger (1) having been elevated by moving the hand-lever (2), the mass is introduced into the hopper (3). By pressing the hand-lever (2) down the mass is forced into the mould; without raising the lever the swing-bed is then pushed around to the right, as shown in Fig. 603, and the mould lifted out by the handle (7). The suppository may be removed from the mould by gently sliding one of the halves over the other, for this gradually forces it out of the mould without the necessity of touching the suppository with the fingers. If the suppository adheres to the mould, it may often be forced out by a slight pressure of the thumb upon the apex. In warm weather the moulds should be cooled before using them by laying them upon ice or by immersion in ice-water. Soap liniment, glycerin, or powdered French chalk have been used as

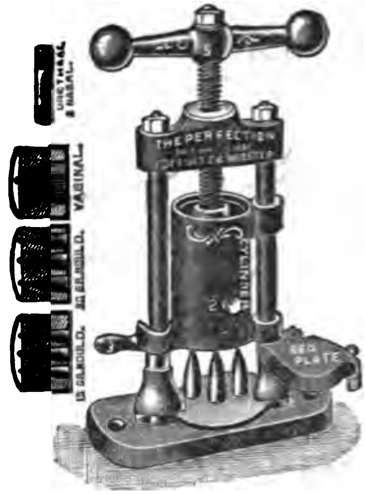
FIG. 603.

Archibald's suppository-machine.

applications to the inside of the moulds when the mass has a tendency to adhere. Moulds accompany the apparatus for making rectal, vaginal, nasal, and urethral suppositories, and any special size can be furnished by the manufacturer.

FIG. 603*a*.

FIG. 603*b*.



Compressed suppository machine.

For making larger quantities of suppositories the same inventor has devised the machine figured in illustrations 603*a* and 603*b*. This is made by Fox, Foultz & Webster. It consists of a cylinder (4) swinging in a frame in which the die or mould is placed; the mass previously made is thrown into the open cylinder (4) (see Fig. 603*a*). The cylinder is then swung back into its place (see Fig. 603*b*), and screw pressure is applied until all resistance is overcome. Before opening the machine, the screw should be loosened slightly; then, on pulling the bed-plate out and pushing it aside (Fig. 603*b*), and gently turning the screw, the suppositories drop out. Repeating the operation, it is obvious that the machine will turn out suppositories as long as any mass remains in the cylinder. Brass dies and a tube are furnished to make 15-grain, 30-grain, vaginal, urethral, or nasal suppositories. Urethral or nasal suppositories are made by screwing on a small brass tube at 2 (Fig. 603*b*) and then pressing the mass through it. A long rod-like suppository is thus forced out, which may be cut into suitable lengths.

Gautier's suppository mould consists of a truncated metallic cone divided longitudinally into two parts, which fit accurately together by grooved surfaces. This cone is bored cylindrically for some distance, the diameter of the hole corresponding at this part with that of the wider end of a suppository, whilst at the upper end of it there is a female screw. Lower down it gradually tapers to a point, assuming the exact shape of a conical suppository. In use, the two parts of the cone are kept in position by an outer jacket of metal, which slips over them. The medicament having been well mixed with the previously grated cacao butter, the exact weight of the mass required in a

suppository is introduced into the cylindro-conical opening through a small funnel. By means of a piston, which exactly fits the cylindrical part, and is constructed with a milled head and screw at the upper end, pressure is then applied, and the finished suppository may be released.

FIG. 604.

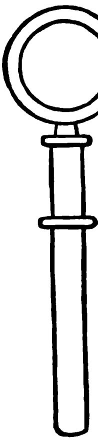
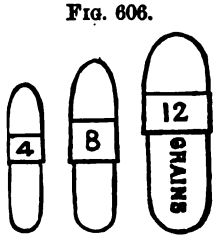


FIG. 605.

Suppositer.

Suppositories are sometimes introduced into the rectum with difficulty. Figs. 604 and 605 show a suppositer to aid in their insertion. The tube is made of hard metal, and has a funnel-shaped top (Fig. 605). The suppository is dropped into the tube, point downward, and this is carefully inserted into the rectum. The piston (Fig. 604) is now applied to the end of the suppository, which is gently pushed into the rectum, the tube being then withdrawn.

FIG. 606.

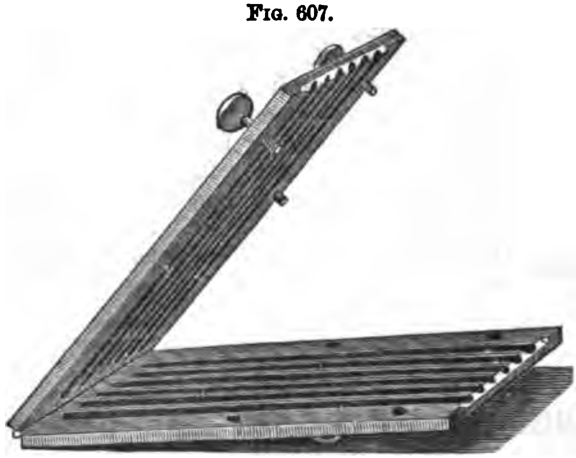


Suppository capsules.

Suppository Capsules.—Dr. F. E. Stewart has suggested the employment of gelatin shells with conical caps, to be used as suppositories. The medicating ingredients are inserted in the lower portion; the upper margin is then moistened with water, and the cap inserted. Before introducing them into the rectum they should be wet with sufficient water to enable them to slip in easily (see Fig. 606).

Urethral Suppositories, or Bougies, are preferably made of gelatin, owing to the difficulty of introducing into the urethra those made from

FIG. 607.



Mitchell's gelatin-bougie mould.

cacao butter, on account of their brittleness. They may be made by melting together three parts of white gelatin, one part of glycerin, and one part of distilled water, by weight, then adding the desired medicament and drawing the mass into a glass tube of suitable size, which has been

previously oiled by sucking a small quantity of oil into it and allowing it to run out. After cooling, the mass is pushed out by means of

FIG. 607a.

Wellcome's urethral suppository.

FIG. 608.

Suppository-box.

an oiled rod, and cut into pieces of suitable length. These should be rolled in lycopodium to prevent adhesion. Fig. 607 shows Mitchell's bougie-mould for making them in quantity.

Henry S. Wellcome, of London, has devised an improved form of urethral suppository upon the same plan as the rectal suppository (see Fig. 588a). This, from its peculiar shape, and particularly on account of the elongated bulb near the top, is less likely to be involuntarily expelled after insertion.

Dispensing Suppositories.—In order to prevent injury to the surface of suppositories in handling them with warm fingers, it is advisable to place the finger-tips for a few moments upon the ice until they are chilled, before placing the suppositories in the box. The latter is preferably furnished with partitions, as made by the Randolph Paper Box Company, of Richmond, Va. (see Fig. 608). In the absence of this special box, the suppositories should be protected by a layer of cotton.

QUESTIONS ON CHAPTER LXVI.—(*Continued.*)

SOLID EXTEMPORANEOUS PREPARATIONS.

What are pills?
Of what two parts does a pill mass consist?
What are the essential requirements of a pill mass?
Give the names of some of the more ordinary excipients.
Give the formula for making a convenient, general excipient.

How may pill masses be conveniently divided into pills?
Give the formulas for the following pills, official in the U. S. Pharmacopœia:
Pilulæ aloes.
Pilulæ aloes et asafœtidæ.
Pilulæ aloes et ferri.
Pilulæ aloes et mastiches.
Pilulæ aloes et myrrhæ.
Pilulæ antimonii compositæ. Give the synonyme.
Pilulæ asafœtidæ.
Pilulæ catharticæ compositæ.
Pilulæ ferri compositæ.
Pilulæ ferri iodidi.
Pilulæ galbani compositæ.
Pilulæ opii.
Pilulæ phosphori.
Pilulæ rhei.
Pilulæ rhei compositæ.
With what substances are pills coated?
How are pills coated?
How are compressed pills or troches made?
What are the advantages of compressed pills?
What varieties of gelatin capsules are made?
How are they made?
How are empty capsules filled?
What are suppositories?
What is ordinarily the best base for suppositories?
How are gelatin suppositories made?
What is the usual size of suppositories?
In what different ways are suppositories made?
How are rolled suppositories made?
How are moulded suppositories made?
What varieties of moulds are used in making them?
What is the greatest objection to individual moulds?
What are the advantages of divided moulds?
What is the best form of divided mould?
Wherein do hinged moulds differ from divided moulds?
How are compressed suppositories made?
What is a suppositer, and for what is it used?
How are capsules used for suppositories?
Of what are urethral suppositories or bougies preferably made, and why?

CHAPTER LXVII.

SOLID EXTEMPORANEOUS PREPARATIONS USED EXTERNALLY.

Cerates, Ointments, Plasters, and Papers.

Cerata. *Cerates.*

Cerates are unctuous substances of such consistence that they may be easily spread, at ordinary temperatures, upon muslin or similar material with a spatula, and yet not so soft as to liquefy and run when applied to the skin. They are mostly used as dressings for inflamed surfaces, and are generally made with oil, lard, or petrolatum for a basis, with sufficient wax to give the desired consistence. Owing to the presence of wax (*Cera*), they are called *Cerates.* Paraffin, spermaceti, and resin are also used to raise the melting points of oils and fats.

Cerates are made either by *fusion* or by *incorporation.* In the first method, the ingredients are melted together, and the mixture strained, to separate mechanical impurities, and stirred until cold, to render it homogeneous. By incorporation is meant the process which consists in placing the fatty ingredients upon an ointment-slab or pill-tile, or in a mortar, and gradually mixing in the other ingredients, with a spatula or pestle, until a uniform preparation results.

Six cerates are official.

Official Cerates made by Fusion.

Ceratum.	Made by fusing together 300 Gm. of white wax and 700 Gm. of lard, and stirring until cold.
Ceratum Camphoræ.	Made by mixing 100 Gm. of camphor liniment with 300 Gm. of white wax and 600 Gm. of lard, melted together.
Ceratum Cantharidis.	Made by fusing together 180 Gm. of yellow wax, 180 Gm. of resin, and 220 Gm. of lard, straining, adding 320 Gm. of cantharides, previously macerated with 150 C.c. of oil of turpentine, digesting until the oil of turpentine has evaporated, and stirring until cold.
Ceratum Cetacei.	Made by fusing together 100 Gm. of spermaceti, 350 Gm. of white wax, and 550 Gm. of olive oil, and stirring until cold.
Ceratum Resinæ.	Made by fusing together 350 Gm. of resin, 150 Gm. of yellow wax, and 500 Gm. of lard, straining, and cooling.

Official Cerate made by Incorporation.

Ceratum Plumbi Subacetatis.	Made by incorporating 200 Gm. of solution of lead subacetate with 800 Gm. of camphor cerate.

OFFICIAL PROCESSES FOR CERATES.

CERATUM. *U. S.* Cerate.

	Metric.	Old form.
White Wax	300 Gm.	4 oz. av. 350 gr.
Lard	700 Gm.	11 oz. av. 88 gr.
To make	1000 Gm.	16 oz. av.

Melt them together, and stir the mixture constantly until it is cool.

CERATUM CAMPHORÆ. *U. S.* Camphor Cerate.

	Metric.	Old form.
Camphor Liniment	100 Gm.	1 oz. av.
White Wax	300 Gm.	3 oz. av.
Lard	600 Gm.	6 oz. av.
To make	1000 Gm.	10 oz. av.

Melt the White Wax and Lard with the aid of a gentle heat; then add the Camphor Liniment, and stir the mixture occasionally, until it has become cold.

CERATUM CANTHARIDIS. *U. S.* Cantharides Cerate.

	Metric.	Old form.
Cantharides, in No. 60 powder	320 Gm.	5 oz. av. 52 gr.
Yellow Wax	180 Gm.	2 oz. av. 385 gr.
Resin	180 Gm.	2 oz. av. 385 gr.
Lard	220 Gm.	3 oz. av. 227 gr.
Oil of Turpentine	150 C.c.	2¼ fl. oz.
To make	1000 Gm.	16 oz. av.

Moisten the Cantharides with the Oil of Turpentine, and set the mixture aside, well covered, for forty-eight hours. Then add it to the Yellow Wax, Resin, and Lard, previously melted and strained through muslin, and keep the mixture in a liquid condition, by means of a water-bath, stirring occasionally, until its weight has been reduced to 1000 grammes. Then remove it from the bath, and stir it occasionally until it is cool.

CERATUM CETACEI. *U. S.* Spermaceti Cerate.

	Metric.	Old form.
Spermaceti	100 Gm.	1 oz. av.
White Wax	350 Gm.	3½ oz. av.
Olive Oil	550 Gm.	5½ oz. av.
To make	1000 Gm.	10 oz. av.

Melt together the Spermaceti and White Wax; then add the Olive Oil previously heated, and stir the mixture constantly until it is cool.

CERATUM PLUMBI SUBACETATIS. *U. S.* **Cerate of Lead Subacetate.**

[GOULARD'S CERATE.]

	Metric.	Old form.
Solution of Lead Subacetate	200 Gm.	1½ fl. dr.
Camphor Cerate	800 Gm.	1 oz. av.
To make	1000 Gm.	about 1 oz.

Mix them thoroughly. This Cerate should be freshly prepared, when wanted.

CERATUM RESINÆ. *U. S.* **Resin Cerate.** [BASILICON OINTMENT.]

	Metric.	Old form.
Resin	350 Gm.	3½ oz. av.
Yellow Wax	150 Gm.	1½ oz. av.
Lard	500 Gm.	5 oz. av.
To make	1000 Gm.	10 oz. av.

Melt them together at a moderate heat, strain the mixture through muslin, and allow it to cool without stirring. In cold weather use the following proportions:

Resin, 350 Gm. [old form 3½ oz. av.]; Yellow Wax, 120 Gm. [old form 1 oz. av. 87 gr.]; Lard, 530 Gm. [old form 5 oz. av. 132 gr.].

Unguenta. *Ointments.*

Ointments are fatty preparations, of a softer consistence than cerates, intended to be applied to the skin by inunction. The medicating ingredients are combined with a basis of lard, petrolatum, or similar substance. Ointments are made in several ways: 1. By fusion. 2. By incorporation. 3. By chemical reaction.

1. **By Fusion.**—In making ointments in this way, care must be observed not to apply sufficient heat to burn the constituents. Cerates and ointments may be strained through flannel or muslin to separate mechanical impurities, and, if desired, some of them can be filtered through paper. (See Hot Filtration.)

2. **By Incorporation.**—The method of making ointments by incorporation is more frequently used than any other. The medicating ingredients used are nearly always insoluble in the basis, and it is necessary, therefore, to reduce them to a fine state of division in order to facilitate their absorption or medicinal action. The usual mode of procedure is to place the fatty basis upon an ointment-slab, and the medicating substance close by. The latter, if in fine powder, is first mixed with a *small portion* of the basis by rubbing both backward and forward with the blade of a spatula until the mixture is perfectly smooth. It is then a very simple operation to dilute this small quantity of concentrated ointment by incorporating it with the rest of the basis, by using the spatula in the same way. If extracts are to be incorporated, they are softened by adding a little water or diluted alcohol, until a smooth paste is made, which is then mixed with the basis with a spatula. An excellent ointment-slab is made by setting a plate of ground glass in a wooden

frame or slide (see page 1106). Ointments are sometimes made in a mortar with the pestle; but this mode is less convenient. Lard should be benzoinated or otherwise protected from rancidity.

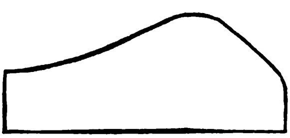
In incorporating ointments containing substances which act on steel, horn spatulas may be used. These may either be a single blade of

FIG. 609.

Spatula (all horn).

horn cut into a suitable shape, or provided with a handle, as shown in Fig. 609; see also Fig. 215, page 193. When large quantities of ointments are required to be made by incorporation, as is sometimes the case in hospitals, dispensaries, etc., an ointment-trowel may be made by cutting a mason's trowel into the shape shown in Figs. 610 and 611,—the former giving the bottom-view, the latter the side-view. This affords a large working surface, and the incorporation can be performed quickly.

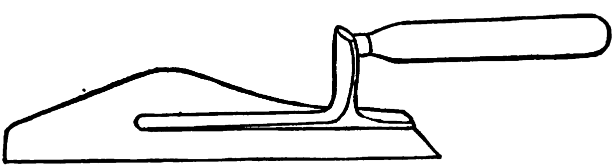
FIG. 610.



Ointment-trowel (bottom-view).

3. **By Chemical Reaction.**—The only official ointment that is made by chemical reaction is the ointment of mercuric nitrate. In

FIG. 611.



Ointment-trowel (side-view).

this, the olein of the oil is converted into elaidin through the action of heat and nitric acid; solution of mercuric nitrate is then incorporated with the elaidin base.

Maxims to be observed in making or dispensing Ointments.—1. They should never be dispensed if they have the slightest taint of rancidity. 2. They should always be smooth and free from grittiness or irritating particles. 3. Ointments containing free acid, iodine, or tannin should not be rubbed with an iron or steel spatula, on account of the chemical action on the metal.

Official Ointments made by Fusion.

Unguentum.	Made by fusing together 800 Gm. of lard and 200 Gm. of yellow wax.
Unguentum Aquæ Rosæ.	Made by fusing together at a moderate heat 600 C.c. of expressed oil of almond, 125 Gm. of spermaceti, and 125 Gm. of white wax, gradually adding 190 C.c. of rose water, in which 5 Gm. of sodium borate has been dissolved, and stirring until a uniformly soft and creamy mixture is obtained.
Unguentum Diachylon.	Made by fusing together 500 Gm. of lead plaster with 490 Gm. of olive oil, allowing the mass to become cool, and then adding 10 C.c. of oil of lavender flowers, stirring constantly until cold.

Official Ointments made by Fusion.—*Continued.*

Unguentum Picis Liquidæ.	Made by fusing at a moderate heat 375 Gm. of lard and 125 Gm. of yellow wax, then adding 500 Gm. of tar, straining, and stirring constantly until cool.

Official Ointments made by Incorporation.

Unguentum Acidi Carbolici.	Made by incorporating thoroughly 5 Gm. of carbolic acid with 95 Gm. of ointment.
Unguentum Acidi Tannici.	Made by incorporating thoroughly 20 Gm. of tannic acid with 80 Gm. of benzoinated lard, avoiding the use of an iron spatula.
Unguentum Belladonnæ.	Made by rubbing 10 Gm. of alcoholic extract of belladonna with 5 C.c. of diluted alcohol until soft, then incorporating the mixture thoroughly with 85 Gm. of benzoinated lard.
Unguentum Chrysarobini.	Made by incorporating thoroughly 5 Gm. of chrysarobin with 95 Gm. of benzoinated lard.
Unguentum Gallæ.	Made by incorporating thoroughly 20 Gm. of powdered nutgall with 80 Gm. of benzoinated lard.
Unguentum Hydrargyri.	Made by mixing 500 Gm. of mercury with 20 Gm. of oleate of mercury, then adding 250 Gm. of lard and 230 Gm. of suet, previously melted together and partially cooled, continuing the trituration until globules of mercury cease to be visible under a magnifying power of 10 diameters.
Unguentum Hydrargyri Ammoniati.	Made by incorporating thoroughly 10 Gm. of ammoniated mercury with 90 Gm. of benzoinated lard.
Unguentum Hydrargyri Oxidi Flavi.	Made by incorporating thoroughly 10 Gm. of yellow mercuric oxide with 90 Gm. of ointment.
Unguentum Hydrargyri Oxidi Rubri.	Made by rubbing 10 Gm. of red mercuric oxide with 5 Gm. of castor oil, then adding sufficient ointment to make 100 Gm.
Unguentum Iodi.	Made by rubbing 4 Gm. of iodine and 1 Gm. of potassium iodide with 2 C.c. of water, and incorporating the mixture thoroughly with 93 Gm. of benzoinated lard.
Unguentum Iodoformi.	Made by incorporating thoroughly 10 Gm. of iodoform with 90 Gm. of benzoinated lard.
Unguentum Plumbi Carbonatis.	Made by incorporating thoroughly 10 Gm. of lead carbonate with 90 Gm. of benzoinated lard.
Unguentum Plumbi Iodidi.	Made by incorporating thoroughly 10 Gm. of lead iodide with 90 Gm. of benzoinated lard.
Unguentum Potassii Iodidi.	Made by dissolving 12 Gm. of potassium iodide and 1 Gm. of sodium hyposulphite in 10 C.c. of boiling water, in a warm mortar, then incorporating the mixture thoroughly with 77 Gm. of benzoinated lard.
Unguentum Stramonii.	Made by rubbing 10 Gm. of extract of stramonium seed with 5 C.c. of water until soft, then incorporating the mixture thoroughly with 85 Gm. of benzoinated lard.
Unguentum Sulphuris.	Made by incorporating thoroughly 300 Gm. of washed sulphur with 700 Gm. of benzoinated lard.
Unguentum Veratrinæ.	Made by rubbing 4 Gm. of veratrine with 6 Gm. of olive oil, and incorporating the mixture thoroughly with 90 Gm. of benzoinated lard.
Unguentum Zinci Oxidi.	Made by sifting 200 Gm. of zinc oxide on the surface of 800 Gm. of melted benzoinated lard, then incorporating the mixture thoroughly.

Official Ointment made by Chemical Reaction.

Unguentum Hydrargyri Nitratis.	See page 1250.

UNGUENTUM. *U. S.* Ointment.

	Metric.	Old form.
Lard	800 Gm.	4 oz. av.
Yellow Wax	200 Gm.	1 oz. av.
To make	1000 Gm.	5 oz. av.

Melt the Yellow Wax, and gradually add to it the Lard; then stir the mixture constantly until it is cool.

UNGUENTUM ACIDI CARBOLICI. *U.S.* **Ointment of Carbolic Acid.**

	Metric.	Old form.
Carbolic Acid	5 Gm.	22 grains.
Ointment	95 Gm.	416 grains.
To make	100 Gm.	1 oz. av.

Mix them thoroughly.

UNGUENTUM ACIDI TANNICI. *U.S.* **Ointment of Tannic Acid.**

	Metric.	Old form.
Tannic Acid, in fine powder	20 Gm.	88 grains.
Benzoinated Lard	80 Gm.	350 grains.
To make	100 Gm.	1 oz. av.

Rub the Tannic Acid with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of iron utensils.

UNGUENTUM AQUÆ ROSÆ. *U.S.* **Ointment of Rose Water.**
[COLD CREAM.]

	Metric.	Old form.
Spermaceti	125 Gm.	1 oz. av. 400 gr.
White Wax	120 Gm.	1 oz. av. 370 gr.
Expressed Oil of Almond	600 C.c.	9 fl. oz.
Stronger Rose Water	190 C.c.	3 fl. oz.
Sodium Borate, in fine powder	5 Gm.	88 grains.
To make about	1000 Gm.	about 16 oz. av.

Reduce the Spermaceti and the White Wax to fine shavings, and melt them at a moderate heat. Then add the expressed Oil of Almond, pour the mixture into a warmed, shallow Wedgwood mortar, carefully add, without stirring, the whole of the Stronger Rose Water in which the Sodium Borate had previously been dissolved, and stir rapidly and continuously, until the mixture becomes uniformly soft and creamy.

UNGUENTUM BELLADONNÆ. *U.S.* **Belladonna Ointment.**

	Metric.	Old form.
Alcoholic Extract of Belladonna Leaves	10 Gm.	44 grains.
Diluted Alcohol	5 C.c.	½ fl. dr.
Benzoinated Lard	85 Gm.	374 grains.
To make	100 Gm.	about 1 oz. av.

Rub the Extract with Diluted Alcohol until it is uniformly soft, then gradually add the Lard, and mix thoroughly.

UNGUENTUM CHRYSAROBINI. *U.S.* **Chrysarobin Ointment.**

	Metric.	Old form.
Chrysarobin	5 Gm.	22 grains.
Benzoinated Lard	95 Gm.	416 grains.
To make	100 Gm.	1 oz. av.

Rub the Chrysarobin with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM DIACHYLON. *U. S.* Diachylon Ointment.

	Metric.	Old form.
Lead Plaster	500 Gm.	219 grains.
Olive Oil	490 Gm.	214 grains.
Oil of Lavender Flowers	10 C.c.	80 minims.
To make	1000 Gm.	about 1 oz.

Melt together the Lead Plaster and the Olive Oil, on a water-bath; then, having allowed the mixture to become partly cool, add the Oil of Lavender Flowers, and stir constantly, until the Ointment is cold.

UNGUENTUM GALLÆ. *U. S.* Nutgall Ointment.

	Metric.	Old form.
Nutgall, in No. 80 powder	20 Gm.	88 grains.
Benzoinated Lard	80 Gm.	350 grains.
To make	100 Gm.	1 oz. av.

Rub the Nutgall with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM HYDRARGYRI. *U. S.* Mercurial Ointment.

[BLUE OINTMENT.]

	Metric.	Old form.
Mercury	500 Gm.	1 oz. av.
Lard	250 Gm.	½ oz. av.
Suet	230 Gm.	201 grains.
Oleate of Mercury	20 Gm.	18 grains.
To make	1000 Gm.	2 oz. av.

Triturate the Oleate of Mercury with the Mercury, gradually added, in a mortar, until globules of the metal are no longer visible. Then add the Lard and Suet, previously melted together and partially cooled, and continue the trituration until globules of Mercury are no longer visible under a lens magnifying ten diameters.

UNGUENTUM HYDRARGYRI AMMONIATI. *U. S.* Ointment of Ammoniated Mercury.

	Metric.	Old form.
Ammoniated Mercury, in very fine powder	10 Gm.	44 grains.
Benzoinated Lard	90 Gm.	394 grains.
To make	100 Gm.	about 1 oz.

Rub the Ammoniated Mercury with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM HYDRARGYRI NITRATIS. *U. S.* Ointment of Mercuric Nitrate. [CITRINE OINTMENT.]

	Metric.	Old form.
Mercury	70 Gm.	80 grains.
Nitric Acid	175 Gm.	1 fl. dr.
Lard Oil	760 Gm.	834 grains.
		about 1 oz. av.

Heat the Lard Oil, in a glass or porcelain vessel, to a temperature of 100° C. (212° F.); then withdraw the heat, gradually add 70 Gm. [old form 24 minims] of Nitric Acid, and, when the reaction moderates, reapply the heat, until effervescence ceases. Then allow the mixture to cool to about 40° C. (104° F.). Having dissolved the Mercury in the remainder of the Nitric Acid with the aid of sufficient heat to prevent the solution from crystallizing, add this solution to the mixture. When the mass has become entirely cold, mix it thoroughly by trituration, avoiding the use of a metallic spatula.

UNGUENTUM HYDRARGYRI OXIDI FLAVI. *U. S.* **Ointment of Yellow Mercuric Oxide.**

	Metric.	Old form.
Yellow Mercuric Oxide, in very fine powder	10 Gm.	44 grains.
Ointment	90 Gm.	394 grains.
To make	100 Gm.	1 oz. av.

Rub the Yellow Mercuric Oxide with the Ointment, gradually added, until they are thoroughly mixed.

UNGUENTUM HYDRARGYRI OXIDI RUBRI. *U. S.* **Ointment of Red Mercuric Oxide.**

	Metric.	Old form.
Red Mercuric Oxide, in very fine powder	10 Gm.	44 grains.
Castor Oil	5 Gm.	22 grains.
Ointment	85 Gm.	372 grains.
To make	100 Gm.	1 oz. av.

Triturate the Red Mercuric Oxide with the Castor Oil, until a perfectly smooth mixture results; then gradually incorporate the Ointment, and mix thoroughly. This is known commonly as *Red Precipitate Ointment.*

UNGUENTUM IODI. *U. S.* **Iodine Ointment.**

	Metric.	Old form.
Iodine	4 Gm.	18 grains.
Potassium Iodide	1 Gm.	4 grains.
Water	2 C.c.	8 minims.
Benzoinated Lard	93 Gm.	418 grains.
To make	100 Gm.	about 1 oz.

Rub the Iodine and the Potassium Iodide, first with the Water, and then with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of a metallic spatula. This preparation should be freshly made, when required.

UNGUENTUM IODOFORMI. *U.S.* Iodoform Ointment.

	Metric.	Old form.
Iodoform, in very fine powder	10 Gm.	44 grains.
Benzoinated Lard	90 Gm.	394 grains.
To make	100 Gm.	1 oz. av.

Rub the Iodoform with the Benzoinated Lard, gradually added, until they are thoroughly mixed. This preparation should be freshly made, when required.

UNGUENTUM PICIS LIQUIDÆ. *U.S.* Tar Ointment.

	Metric.	Old form.
Tar	500 Gm.	½ oz. av.
Yellow Wax	125 Gm.	55 grains.
Lard	375 Gm.	165 grains.
To make	1000 Gm.	1 oz. av.

Melt together the Yellow Wax and the Lard at a moderate heat. Then incorporate the Tar, strain the mixture through muslin, and stir the Ointment constantly until it is cool.

UNGUENTUM PLUMBI CARBONATIS. *U.S.* Ointment of Lead Carbonate.

	Metric.	Old form.
Lead Carbonate, in very fine powder	10 Gm.	44 grains.
Benzoinated Lard	90 Gm.	394 grains.
To make	100 Gm.	1 oz. av.

Rub the Lead Carbonate with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM PLUMBI IODIDI. *U.S.* Ointment of Lead Iodide.

	Metric.	Old form.
Lead Iodide, in very fine powder	10 Gm.	44 grains.
Benzoinated Lard	90 Gm.	394 grains.
To make	100 Gm.	1 oz. av.

Rub the Lead Iodide with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM POTASSII IODIDI. *U.S.* Ointment of Potassium Iodide.

	Metric.	Old form.
Potassium Iodide	12 Gm.	53 grains.
Sodium Hyposulphite	1 Gm.	5 grains.
Water (hot)	10 C.c.	40 minims.
Benzoinated Lard	77 Gm.	340 grains.
To make	100 Gm.	about 1 oz.

Dissolve the Potassium Iodide and the Sodium Hyposulphite in the hot Water, then mix the solution with the Benzoinated Lard.

UNGUENTUM STRAMONII. *U. S.* Stramonium Ointment.

	Metric.	Old form.
Extract of Stramonium Seed	10 Gm.	44 grains.
Diluted Alcohol	5 Gm.	20 minims.
Benzoinated Lard	85 Gm.	872 grains.
To make	100 Gm.	about 1 oz.

Rub the Extract with the Diluted Alcohol until it is uniformly soft; then gradually add the Benzoinated Lard, and mix thoroughly.

UNGUENTUM SULPHURIS. *U. S.* Sulphur Ointment.

	Metric.	Old form.
Washed Sulphur	300 Gm.	132 grains.
Benzoinated Lard	700 Gm.	306 grains.
To make	1000 Gm.	1 oz. av.

Rub the Washed Sulphur with the Benzoinated Lard, gradually added, until they are thoroughly mixed.

UNGUENTUM VERATRINÆ. *U. S.* Veratrine Ointment.

	Metric.	Old form.
Veratrine	4 Gm.	18 grains.
Olive Oil	6 Gm.	26 grains.
Benzoinated Lard	90 Gm.	394 grains.
To make	100 Gm.	1 oz. av.

Rub the Veratrine with the Olive Oil, in a mortar; then gradually add the Benzoinated Lard, and mix thoroughly.

UNGUENTUM ZINCI OXIDI. *U. S.* Ointment of Zinc Oxide.

	Metric.	Old form.
Zinc Oxide	200 Gm.	90 grains.
Benzoinated Lard	800 Gm.	360 grains.
To make	1000 Gm.	about 1 oz.

Sift the Zinc Oxide, through a No. 20 sieve, upon the surface of the Benzoinated Lard, previously melted, and incorporate it by stirring, which is to be continued until the Ointment is cool.

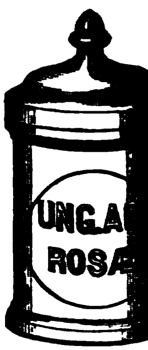
Preserving and Dispensing Cerates and Ointments.—As has been already stated, fatty substances may be preserved from rancidity by digesting them with balsamic resins, poplar buds, styrax, etc. To preserve them during hot weather, they require in addition a cool temperature

and freedom from exposure to the air (see page 1045). When a fresh lot of ointment is made to replenish a stock jar, the jar should be thoroughly cleaned, and the old ointment remaining thrown away, unless it is certain that the latter is entirely free from rancidity, as otherwise it would soon cause the new ointment to become rancid. Amber glass, stoneware, or porcelain jars are the best receptacles for ointments. Queen's-ware or china jars soon permit the fatty substance to penetrate through the minute fissures which are always present. Fig. 612 shows a German porcelain jar, which is just as useful for preserving ointments as it is for holding a penetrating substance like green soap. Fig. 613 illustrates an amber glass stock ointment-jar made by Whitall, Tatum & Co. The letters for the label are blown in the glass, and then ground off, so that the label is inde-

FIG. 612.

Porcelain jar.

FIG. 613.



Ointment-jar (amber glass).

FIG. 614.

Jar for dispensing ointments.

FIG. 615.

Ointment-jar, wooden top.

FIG. 616.

German ointment-jar.

structible. The only difficulty is that the label requires a strong light to enable it to be seen clearly. For dispensing ointments the opal glass jar is very useful. One of the best shapes is shown in Fig. 614. The bottom is rounded, so that the patient can easily reach all the ointment with the finger, and the top is metallic, with a screw-cap. There is room for the label on the glass. The jar shown in Fig. 615 is not recommended. The bottom forms an angle with the sides which collects the ointment, the shoulder also catches a portion, whilst the wooden top is very apt to shrink, so that there is difficulty in getting it off without breaking it. The glass box shown in Fig. 616 has a wooden top with a lithographed label. These are certainly the handsomest ointment-boxes and the most expensive. The lids will often contract, however, and give trouble in getting them on and off. Collapsible tubes, made by A. H. Wirz & Co., of Philadelphia, are used in dispensing soft ointments. If the latter contain no acid or corrosive

constituents they answer an admirable purpose as containers for them (see Fig. 617). These soft metal tubes are filled from the bottom with the ointment melted with just sufficient heat to permit it to be poured, and then closed by folding the ends together, as shown in one of them, and rolling the fold over twice with a pair of pliers. A screw-cap is placed upon the top, and the ointment is perfectly protected from exposure. To obtain a little, the screw-cap is taken off, and the bottom of the tube slightly pressed between the thumb and finger, when a portion of the ointment quickly exudes. Of the very cheap boxes, those turned from wood are totally *unfit* for dispensing ointments. The ointment quickly penetrates through the grain of the wooden bottom, and the greasy abomination is exceedingly unwelcome to most housekeepers. A chip-wood box covered with pasteboard is preferable, because it offers more resistance to the passage of the fatty substance (see Fig. 618). The impervious walnut boxes, made by gluing several veneers of hard wood together, are still better.

FIG. 617.

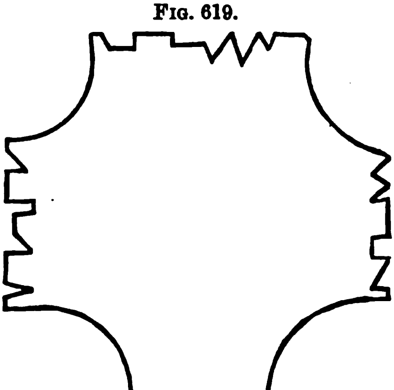
Collapsible tubes.

FIG. 618.

Paper-covered chip box.

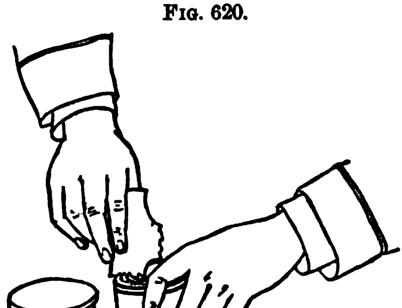
Finishing Ointments.—Some skill is required to fill a box with ointment neatly and deftly by using a spatula without soiling the exterior of the box. The surface is generally scraped with the edge of the spatula to give it a smooth finish, and this is sometimes held near a hot surface, like a stove-plate, to give it a gloss. Occasionally it will be found that some nervous patients desire to be assured that an ointment or cerate has not been tampered with by a servant, and it may be desirable for other reasons to finish the surface of an ointment with a distinctive design. This may be done by cutting a piece of tin into a shape similar to that shown in Fig. 619. By placing one of the teeth on the edge of the jar (see Fig. 620),

FIG. 619.



Ointment-finisher.

FIG. 620.



Finishing ointments.

and slowly rotating it, with alternate pauses, a very neat finish may be given to the surface. The finisher (see Fig. 619) shows four sides, and is of course capable of making four patterns.

Emplastra. *Plasters.*

Plasters are substances intended for external application, of such consistence that they adhere to the skin, and require the aid of heat in spreading them. The word plaster is applied not only to the solid substance which is used to spread upon the muslin, leather, paper, or other material which serves to hold it, but to the spread plaster itself. The basis of most of the officinal plasters is either lead plaster, a gum-resin, or Burgundy pitch.

In the preparation of plasters, care is requisite that the heat employed be not sufficiently elevated to produce decomposition, nor so long continued as to drive off any volatile ingredient upon which the virtues of the preparation may in any degree depend. After having been prepared, they are usually shaped into cylindrical rolls, and wrapped in paper to exclude the air. Plasters should be firm at ordinary temperatures, should spread easily when heated, and, after being spread, should remain soft, pliable, and adhesive, without melting, at the heat of the human body. When long kept, they are apt to change color and to become hard and brittle; and, as this alteration is most observable upon their surface, it must depend chiefly upon the action of the air, which should therefore be as much as possible excluded. The defect may usually be remedied by melting the plaster with a moderate heat and adding a sufficient quantity of oil to give it the due consistence. To soften the surface of a spread plaster, it should be brushed with a little tincture of camphor. *Thirteen* plasters are official.

Official Plasters containing Gum-Resins as their Basis.

Emplastrum Ammoniaci cum Hydrargyro.	Made by triturating 180 Gm. of mercury with 8 Gm. of oleate of mercury until the former is extinguished; then incorporating 720 Gm. of ammoniac, which has previously been digested in 1000 C.c. of diluted acetic acid, until emulsionized; lastly, adding sufficient melted lead plaster to make 1000 Gm.

Official Plasters containing Lead or Resin Plaster as their Basis.

Emplastrum Arnicæ.	Made by incorporating thoroughly 330 Gm. of extract of arnica root with 670 Gm. of resin plaster, previously melted by means of a water-bath.
Emplastrum Belladonnæ.	Made by melting together 400 Gm. each of resin plaster and soap plaster, and incorporating 200 Gm. of extract of belladonna leaves.
Emplastrum Ferri.	Made by melting together 720 Gm. of lead plaster, 50 Gm. of olive oil, and 140 Gm. of Burgundy pitch; then adding 90 Gm. of ferric hydrate, and stirring until cool.
Emplastrum Hydrargyri.	Made by triturating 300 Gm. of mercury with 12 Gm. of oleate of mercury, and adding enough lead plaster to make 1000 Gm.
Emplastrum Opii.	Made by rubbing 60 Gm. of extract of opium with 80 C.c. of water until soft; then adding to it 180 Gm. of Burgundy pitch and 760 Gm. of lead plaster, previously melted together; lastly, heating and stirring until of the proper consistence.
Emplastrum Plumbi.	Made by rubbing gradually 3200 Gm. of lead oxide with 6000 Gm. of olive oil, placing in a suitable vessel, and adding 1000 C.c. of water to the mixture, boiling the whole together, and adding cautiously a little water, from time to time, as it is consumed.

Official Plasters containing Lead or Resin Plaster as their Basis.—*Continued.*

Emplastrum Resinæ.	Made by adding 140 Gm. of resin to 800 Gm. of lead plaster and 60 Gm. of yellow wax, previously melted; then mixing the whole thoroughly.
Emplastrum Saponis.	Made by rubbing 100 Gm. of soap with sufficient water to form a soft mass; then mixing thoroughly with 900 Gm. of lead plaster previously melted.

Official Plasters containing Burgundy or Canada Pitch as their Basis.

Emplastrum Picis Burgundicæ.	Made by fusing together 800 Gm. of Burgundy pitch and 150 Gm. of yellow wax, incorporating 50 Gm. of olive oil, and stirring constantly until cool.
Emplastrum Picis Cantharidatum.	Made by heating 80 Gm. of cerate of cantharides to about 212° F., straining, and adding to the strained liquid 920 Gm. of Burgundy pitch; lastly, melting them together and stirring until cool.

Official Spread Plasters.

Emplastrum Capsici.	Made by spreading a thin and even layer of melted resin plaster upon muslin, and allowing to cool; then applying a thin coating of oleoresin of capsicum by means of a brush.
Emplastrum Ichthyocollæ.	Made by dissolving 10 Gm. of isinglass in sufficient hot water to make the solution weigh 120 Gm.; then spreading one-half of this upon taffeta by means of a brush; then adding 1 Gm. of glycerin and 40 Gm. of alcohol to the remaining solution, and applying in the same manner; lastly, coating the reverse of the taffeta with tincture of benzoin, and allowing to dry.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO. *U. S.* Ammoniac Plaster with Mercury.

	Metric.	Old form.
Ammoniac	720 Gm.	11 oz. av. 228 gr.
Mercury	180 Gm.	2 oz. av. 385 gr.
Oleate of Mercury	8 Gm.	56 grains.
Diluted Acetic Acid	1000 C.c.	1 pint.
Lead Plaster, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Digest the Ammoniac with the Diluted Acetic Acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsified; then strain, and evaporate the strained liquid by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling. Triturate the Oleate of Mercury with the Mercury gradually added, until globules of the metal cease to be visible. Next add, gradually, the Ammoniac, while yet hot; and finally, having added enough Lead Plaster, previously melted by means of a water-bath, to make the mixture weigh 1000 Gm. [old form 16 oz. av.], mix the whole thoroughly.

EMPLASTRUM ARNICÆ. *U. S.* Arnica Plaster.

	Metric.	Old form.
Extract of Arnica Root	330 Gm.	5 oz. av.
Resin Plaster	670 Gm.	11 oz. av.
To make	1000 Gm.	16 oz. av.

Add the Extract to the Plaster, previously melted by means of a water-bath, and mix them thoroughly.

EMPLASTRUM BELLADONNÆ. *U. S.* Belladonna Plaster.

	Metric.	Old form.
Alcoholic Extract of Belladonna Leaves	200 Gm.	2 oz. av.
Resin Plaster	400 Gm.	4 oz. av.
Soap Plaster	400 Gm.	4 oz. av.
To make	1000 Gm.	10 oz. av.

Melt the Plasters on a water-bath; then add the Extract of Belladonna Leaves, and continue the heat, stirring constantly, until a homogeneous mass results.

EMPLASTRUM CAPSICI. *U. S.* Capsicum Plaster.

Oleoresin of Capsicum,
Resin Plaster, each, a sufficient quantity.

Melt the Resin Plaster at a gentle heat, spread a thin and even layer of it upon muslin, and allow it to cool. Then, having cut off a piece of the required size, apply a thin coating of Oleoresin of Capsicum, by means of a brush, leaving a narrow, blank margin along the edges.

A space of 10 Centimetres [old form 4 inches] square should contain about 0.25 Gm. [old form 4 grains] of Oleoresin of Capsicum.

EMPLASTRUM FERRI. *U. S.* Iron Plaster. [Strengthening Plaster.]

	Metric.	Old form.
Ferric Hydrate, dried at a temperature not exceeding 80° C. (176° F.)	90 Gm.	1 oz. av. 192 gr.
Olive Oil	50 Gm.	350 grains.
Burgundy Pitch	140 Gm.	2 oz. av. 105 gr.
Lead Plaster	720 Gm.	11 oz. av. 228 gr.
To make	1000 Gm.	16 oz. av.

Melt the Lead Plaster and Burgundy Pitch by means of a water-bath, and add the Olive Oil; then add the Ferric Hydrate, and stir constantly until the mixture thickens on cooling.

EMPLASTRUM HYDRARGYRI. *U. S.* Mercurial Plaster.

	Metric.	Old form.
Mercury	300 Gm.	5 oz. av.
Oleate of Mercury	12 Gm.	84 grains.
Lead Plaster, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Triturate the Mercury with the Oleate of Mercury in a tared capsule until globules of metal are no longer visible. Then place the capsule on a water-bath, add enough Lead Plaster, previously melted, to make the contents weigh 1000 Gm. [old form 16 oz. av.], and mix the whole thoroughly.

EMPLASTRUM ICHTHYOCOLLÆ. *U. S.* Isinglass Plaster.
[Court Plaster.]

	Metric.	Old form.
Isinglass	10 Gm.	155 grains.
Alcohol	40 Gm.	1¼ fl. oz.
Glycerin	1 Gm.	12 minims.

Water,
Tincture of Benzoin, each, a sufficient quantity.

Dissolve the Isinglass in a sufficient quantity of hot Water to make the solution weigh 120 Gm. [old form or measure 4 fl. oz.]. Spread one-half of this, in successive layers, upon taffeta (stretched on a frame), by means of a brush, waiting after each application until the layer is dry. Mix the second half of the Isinglass solution with the Alcohol and Glycerin, and apply it in the same manner. Then reverse the taffeta, coat it on the back with Tincture of Benzoin, and allow it to become perfectly dry. Cut the plaster in pieces of suitable length and preserve them in well-closed vessels. The above-directed quantities are sufficient to cover a piece of taffeta 38 Centimetres [old form 15 inches] square.

EMPLASTRUM OPII. *U. S.* Opium Plaster.

	Metric.	Old form.
Extract of Opium	60 Gm.	1 oz. av.
Burgundy Pitch	180 Gm.	8 oz. av.
Lead Plaster	760 Gm.	12½ oz. av.
Water	80 C.c.	1¼ fl. oz.
To make	1000 Gm.	17 oz. av.

Rub the Extract of Opium with the Water, until it is uniformly soft, and add it to the Burgundy Pitch and Lead Plaster melted together by means of a water-bath; then continue the heat for a short time, stirring constantly, until the moisture is evaporated.

EMPLASTRUM PICIS BURGUNDICÆ. *U. S.* Burgundy Pitch Plaster.

	Metric.	Old form.
Burgundy Pitch	800 Gm.	18 oz. av.
Olive Oil	50 Gm.	850 grains.
Yellow Wax	150 Gm.	2 oz. av. 175 gr.
To make	1000 Gm.	about 16 oz. av.

Melt together the Burgundy Pitch and Yellow Wax, then incorporate the Olive Oil, and stir constantly, until the mass thickens on cooling.

EMPLASTRUM PICIS CANTHARIDATUM. *U. S.* Cantharidal Pitch Plaster. [WARMING PLASTER.]

	Metric.	Old form.
Cerate of Cantharides	80 Gm.	560 grains.
Burgundy Pitch, a sufficient quantity,		
To make	1000 Gm.	16 oz. av.

Melt the Cerate of Cantharides on a water-bath containing boiling water, and continue the heat for fifteen minutes; then strain it through a piece of muslin of close texture so that the Cantharides will be retained on the muslin. To the strained liquid add a sufficient quantity of Burgundy Pitch to make the whole weigh 1000 Gm. [old form 16 oz. av.], render the mixture homogeneous by stirring, remove the heat, and stir the mass until it thickens on cooling.

EMPLASTRUM PLUMBI. *U.S.* Lead Plaster.

[DIACHYLON PLASTER.]

	Metric.	Old form.
Lead Oxide	3200 Gm.	82 oz. av.
Olive Oil	6000 Gm.	63 fl. oz.
Water, a sufficient quantity.		

Mix the Lead Oxide, previously passed through a No. 80 sieve, intimately with about one-half of the Olive Oil, by trituration, and add the mixture to the remainder of the Oil contained in a bright copper boiler of a capacity equal to at least four times the bulk of the ingredients. Then add 1000 C.c. [old form 10 fl. oz.] of boiling Water, and boil the whole together, over a fire, constantly stirring with a wooden spatula, until a small portion, when dropped into cold water, is found to be pliable and tenacious. From time to time add a little Water to replace that lost by evaporation. When the contents of the boiler have acquired a whitish color and are perfectly homogeneous, transfer them to a vessel containing warm water, and as soon as the mass has sufficiently cooled, knead it well with the Water so as to remove the glycerin, renewing the Water from time to time, as long as it may be necessary. Finally divide the mass into rolls of suitable size.

A yellowish-white, pliable, and tenacious, but not greasy mass, gradually acquiring a brownish tint on the outside.

On treating 5 Gm. of Lead Plaster with 25 C.c. of benzol, a somewhat viscid and slightly turbid solution will result, which will separate into a clear and a gelatinous layer after some time, but which should not deposit any sediment (absence of *uncombined lead oxide*).

EMPLASTRUM RESINÆ. *U.S.* Resin Plaster.

[ADHESIVE PLASTER.]

	Metric.	Old form.
Resin, in fine powder	140 Gm.	2 oz. av. 105 gr.
Lead Plaster	800 Gm.	18 oz. av.
Yellow Wax	60 Gm.	420 grains.
To make	1000 Gm.	about 16 oz. av.

Melt the Lead Plaster and Yellow Wax together with a gentle heat; then add the Resin, and, when it is melted, mix the mass thoroughly.

EMPLASTRUM SAPONIS. *U.S.* Soap Plaster.

	Metric.	Old form.
Soap, dried and in coarse powder	100 Gm.	1 oz. av.
Lead Plaster	900 Gm.	9 oz. av.
Water, a sufficient quantity.		

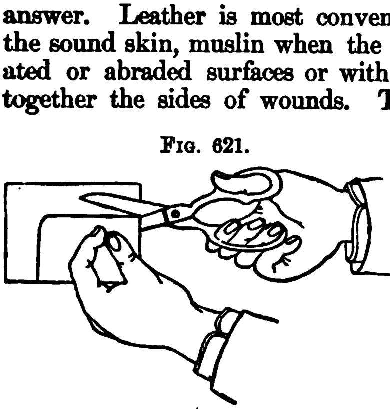
Rub the Soap with enough Water to reduce it to a semi-liquid state; then mix it with the Lead Plaster, previously melted, and evaporate to the proper consistence.

Spreading Plasters.—Since the introduction of machine-spread plasters the preparation of a plaster by a pharmacist upon the prescription of a physician has become almost a "lost art."

Plasters are prepared for use by spreading them upon leather, muslin, or paper, according to the particular purposes they are intended to

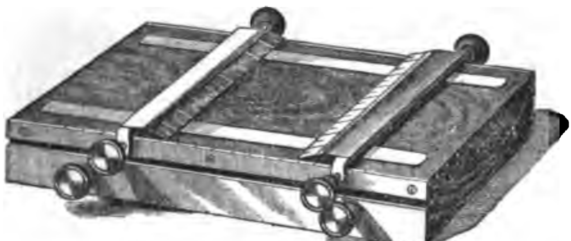
answer. Leather is most convenient when the application is made to the sound skin, muslin when the plaster is used as a dressing to ulcerated or abraded surfaces or with the view of bringing and retaining together the sides of wounds. The leather usually preferred is white sheep-skin, or the kind known commercially as "hemlock splits." A margin about a quarter or half an inch broad should usually be left uncovered, in order to facilitate the removal of the plaster and to prevent the clothing in contact with its edges from being soiled. An accurate outline may be obtained by pasting, or fastening with thumb-tacks, upon the leather a piece of paper so cut as to leave in the centre a vacant space of the required dimensions, and removing the paper when no longer needed. The paper is folded four times. Fig. 621 shows one-fourth of the whole in the act of being cut: the rounded corners give a neater finish than square ones. The same object may often be accomplished by employing two narrow rulers of sheet-tin graduated in inches, and so shaped that each of them will form two sides of a rectangle. These may be applied in such a manner as to enclose within them any given rectangular space, and may be fixed by weights upon the leather, or preferably adjusted by set-screws, while the plaster is spread. The Franciscus machine is constructed on this principle (see Fig. 622).[1] For any other shape, as in the case of plasters for the breast, pieces of tin may be employed having a space within, corresponding to the required outline. Figs. 623, 624, 625, 626, 627, 628, 629, and 630 show patterns for plasters with margins for various parts of the body. Figs. 623 and 624 are for use behind the ears, the pointed portion of the plasters being used for the top. Care must be observed to have the physician designate whether the plaster is intended for the right ear (Fig. 624) or the left ear (Fig. 623). Chest plasters are sometimes cut in the shape of Fig. 625; those intended for use between the shoulders may have the form of Fig. 626. In Fig. 627 a plaster is shown which is intended for the "small of the back," and in Fig. 628 is one for either the right or the left side. Fig. 629 shows a pattern for fastening to kid, to spread a breast plaster on, and Fig. 630 represents the plaster

FIG. 621.



Cutting plaster-paper.

FIG. 622.



Franciscus plaster-board.

[1] The other side of this valuable apparatus can be used as a lozenge-board or pill-machine.

with the margin as spread from such a pattern. The spreading of the plaster is most conveniently accomplished by the use of a spatula or

FIG. 623.

Left ear plaster.

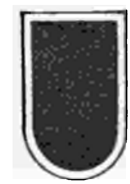
FIG. 624.

Right ear plaster.

FIG. 625.

Chest plaster.

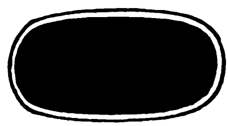
FIG. 626.



Shoulder plaster.

plaster-iron (see Fig. 632). This may be heated by means of a spirit-lamp. Care must be taken that the instrument be not so hot as to discolor or decompose the plaster; and special care is requisite in the case of those plasters which contain a volatile ingredient. A sufficient portion of the plaster should first be melted by the heated instrument, and, having been received on a piece of coarse stiff paper, or in a shallow tin tray open on one side, should, when nearly cool, be transferred to the leather and applied quickly and evenly over its surface. By this plan the melted plaster is prevented from penetrating the leather, as it would be apt to do if applied too hot. Before removing the paper from the edge of the plaster, if this has become so hard as to crack, the iron should be drawn over the line of junction. Fig. 631 shows one method of spreading a small plaster with a spatula. Strips of paper are fastened upon the kid with thumb-tacks (such as are used by draughtsmen: one is shown in the cut in profile), a piece of waste paper is fastened at the top to prevent soiling the margin, the melted plaster is poured upon it, and the spatula, having been previously warmed by

FIG. 627.

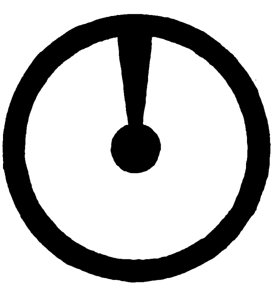


Back plaster.

FIG. 628.

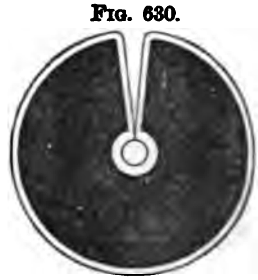
Side plaster.

FIG. 629.



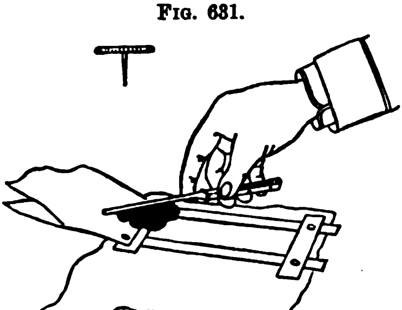
Breast plaster pattern.

FIG. 630.



Breast plaster.

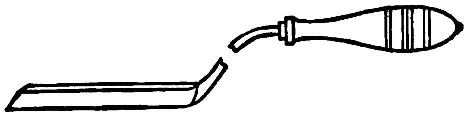
FIG. 631.



Spreading a plaster.

passing it through an alcohol flame or that of a Bunsen burner, is used by quickly passing the edge of the blade over the surface; a portion of the melted plaster precedes the blade in its passage, and thus a thin layer is spread upon the leather. Especial care must be observed not to allow very hot plaster to remain upon the leather, or it may pass through and discolor the back. For large plasters, the plaster-iron (see Fig. 632) may be employed; this is heated, and, owing to the greater weight of metal, it holds the heat much better than the blade of a spatula: it is, however, not so easily nor so quickly used as the latter instrument by those unaccustomed to it. After the plaster has been spread, the strips of paper are carefully removed, and if the plaster is brittle it should be held near the source of heat, so that the strips may be removed without tearing off pieces of the plaster from the leather.

FIG. 632.



Plaster-iron.

Large quantities of stock plasters may be spread by the apparatus shown below. To an oblong rectangular block of hard wood, slightly convex on its upper surface, is attached by a movable joint a sheet-

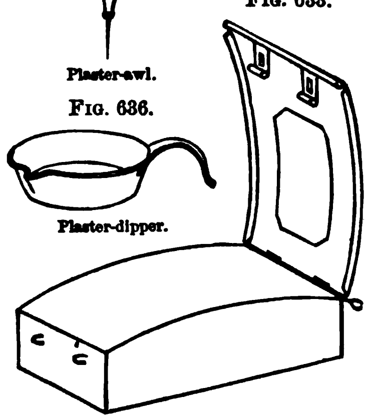
FIG. 635.

Plaster-awl.

FIG. 636.

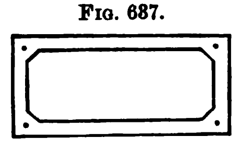
Plaster-dipper.

FIG. 633.



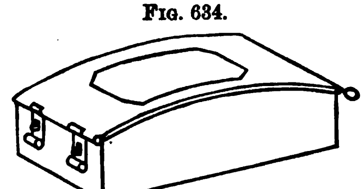
Plaster-block, open.

FIG. 637.



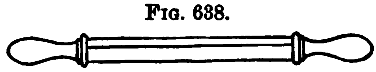
Plaster-pattern.

FIG. 634.



Plaster-block, closed.

FIG. 638.



Plaster-iron (double handle).

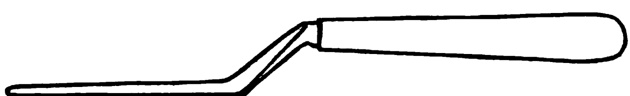
iron frame, with an opening of the dimensions of the plaster to be spread, and clasps at the other end, by which this may be fixed to the block (see Fig. 633). Another portion of the apparatus is a sheet-iron or tin frame, by which the leather is cut out and the margin marked (see Fig. 637). The leather thus prepared is laid on the convex surface of the block; the sheet-iron frame is brought down on it evenly, as shown in Fig. 634;

the plaster, previously melted, but not too hot, is poured on the leather in the centre, and, by means of a square iron bar having a wooden handle at each end (see Fig. 638), which has been heated by a spirit-lamp, it is spread uniformly over the surface, the thickness being regulated by the frame against which the iron is pressed. Any excess of plaster is thus pressed over upon the frame. The heated point of an awl (see Fig. 635) is then drawn along the interior edge of the frame so as to separate the plaster from it, after which the clasps are unfastened and the plaster removed.

The dipper shown in Fig. 636 is well adapted for holding suitable quantities for spreading plasters extemporaneously. If a portion of the various roll plasters be melted and run into a number of these, and the dippers labelled, they will be found very convenient as containers.

Blisters do not usually require the application of heat to spread them: they may be spread on adhesive plaster in the same way as plasters are prepared. The spatula shown in Fig. 639 is well fitted for spreading blisters, as it gives room for the fingers and permits a solid grasp of the handle. The practice of using the thumb in spreading blisters, although

FIG. 639.



Blister-spatula.

tolerated by many good pharmacists, should be regarded as more honored in the breach than in the observance: it is an unnecessary and inelegant procedure, the spatula giving a much smoother finish.

Chartæ. *Papers.*

Papers are preparations intended principally for external application, made either by saturating paper with medicinal substances, or by applying the latter to the surface of the paper by the addition of some adhesive liquid. Only *two* papers are official: they are as follows:

CHARTA POTASSII NITRATIS. *U. S.* Potassium Nitrate Paper.

	Metric.	Old form.
Potassium Nitrate	200 Gm.	1 oz. av.
Distilled Water	800 C.c.	4 fl. oz.

Dissolve the Potassium Nitrate in the Distilled Water. Immerse strips of white, unsized paper in the solution, and dry them. Keep the paper in well-closed vessels. This paper is used in asthma by burning and inhaling the fumes.

CHARTA SINAPIS. *U. S.* Mustard Paper.

	Metric.	Old form.
Black Mustard, in No. 60 powder	100 Gm.	10 oz. av.
India-Rubber	10 Gm.	1 oz. av.

Benzin,
Carbon Disulphide, each, a sufficient quantity.

Pack the Black Mustard in a conical percolator, and gradually pour Benzin upon it until the percolate ceases to produce a permanent, greasy stain upon blotting paper. Remove the powder from the percolator, and dry it by exposure to the air. Having meanwhile dissolved the India-Rubber in a mixture of 100 C.c. [old form 10 fl. oz.], each, of Benzin and Carbon Disulphide, mix the purified Mustard with a sufficient quantity of the solution to produce a semi-liquid magma, and apply this, by means of a suitable brush, to one side of a piece of rather stiff, well-sized paper, so as to cover it completely, and then allow the surface to dry. A surface of sixty square centimetres [old form 9¼ square inches] should contain about 4 Gm. [old form 62 grains] of Black Mustard deprived of oil. Before it is applied to the skin, Mustard Paper should be dipped in warm water for about fifteen seconds.

QUESTIONS ON CHAPTER LXVII.

SOLID EXTEMPORANEOUS PREPARATIONS.

What are cerates? Why are they so called?
How are cerates made?
How many cerates are official?
Give the formulas and official processes for the following cerates, viz.:
Cerate—Give the Latin official name.
Camphor cerate—Give the Latin official name.
Cantharides cerate—Give the Latin official name. Give the synonyme.
Spermaceti cerate—Give the Latin official name.
Cerate of lead subacetate—Give the Latin official name. Give the synonyme.
Resin cerate—Give the Latin official name. Give the synonyme.
What are ointments?
In what different ways are ointments made?
In making ointments by fusion, what precaution is necessary?
How may mechanical impurities be separated?
How are ointments made by incorporation?
What official ointment is made by chemical reaction?
What three maxims should be observed in making or dispensing ointments?
Give the formulas and modes of making the following ointments, viz.:
Ointment of carbolic acid—Give the Latin official name.
Ointment of tannic acid—Give the Latin official name.
Ointment of rose water—Give the Latin official name.
Belladonna ointment—Give the Latin official name.
Chrysarobin ointment—Give the Latin official name.
Diachylon ointment—Give the Latin official name.
Nutgall ointment—Give the Latin official name.
Mercurial ointment—Give the Latin official name. Give the synonyme.
Ointment of ammoniated mercury—Give the Latin official name.
Ointment of mercuric nitrate—Give the Latin official name. Give the synonyme.
Ointment of yellow mercuric oxide—Give the Latin official name.
Ointment of red mercuric oxide—Give the Latin official name.
Iodine ointment—Give the Latin official name.
Iodoform ointment—Give the Latin official name.
Tar ointment—Give the Latin official name.
Ointment of lead carbonate—Give the Latin official name.
Ointment of lead iodide—Give the Latin official name.
Ointment of potassium iodide—Give the Latin official name.

Stramonium ointment—Give the Latin official name.
Sulphur ointment—Give the Latin official name.
Veratrine ointment—Give the Latin official name.
Ointment of zinc oxide—Give the Latin official name.
How may cerates and ointments be preserved from rancidity?
What kinds of jars are the best receptacles for ointments?
What is the best-shaped jar for dispensing ointments?
How are collapsible tubes used for ointments?
What sort of wooden boxes are best for ointments?
How may a neat finish be given to ointments in boxes?
What are plasters?
What is the basis of most of the official plasters?
How many plasters are official?
Give the formulas and modes of making the following plasters, viz.:
Ammoniac plaster with mercury—Give the Latin official name.
Arnica plaster—Give the Latin official name.
Belladonna plaster—Give the Latin official name.
Capsicum plaster—Give the Latin official name.
Iron plaster—Give the Latin official name. Give the synonyme.
Mercurial plaster—Give the Latin official name.
Isinglass plaster—Give the Latin official name. Give the synonyme.
Opium plaster—Give the Latin official name.
Burgundy pitch plaster—Give the Latin official name.
Cantharidal pitch plaster—Give the Latin official name. Give the synonyme.
Lead plaster—Give the Latin official name—Give the synonyme.
Resin plaster—Give the Latin official name—Give the synonyme.
Soap plaster—Give the Latin official name.
Upon what substances are plasters usually spread?
What is the method of proceeding in spreading a plaster upon leather?
What advantage has a plaster-iron over a spatula for spreading plasters?
What advantage has a spatula over a plaster-iron?
How are blisters spread?
What is a good material upon which to spread them?
What are chartæ or papers?
How many are official?
How is potassium nitrate paper prepared?
How is mustard paper prepared?
How is mustard paper used?
How much mustard does each square inch contain?

PART VI.

FORMULARY OF UNOFFICIAL PREPARATIONS.

THE following formulas have been collected principally with the view of saving the labor and time of the pharmacist, who is often suddenly called upon to prepare some remedy for which he may not have a formula in his recipe-book. The author's name is appended to the formula when it is known, and the selection has been carefully made so as to embrace many which are not easy of access. The subjects are arranged according to the order adopted for the official preparations in Parts III. and IV., and, if desired, they may be consulted in connection with the subjects in those parts. The formulas of the preparations of the U. S. Pharmacopœia, 1880, which were not admitted to the present Pharmacopœia, have been added, because many of them are still in active use. As it is very desirable to secure uniformity in practice throughout the United States in the use of unofficial preparations, the National Formulary has been added, and the formulas for many of the preparations which were inserted in the first edition of this work which conflict with these have been dropped. The National Formulary preparations are distinguished by the letters N. F., and the original number of the preparation in the Formulary will be found before the title.

INORGANIC ACIDS.

Hydrobromic Acid Cough Mixture.

(Dr. J. Milner Fothergill's.)

Spirit of Chloroform, B. P.,	40 min.
Hydrobromic Acid (Diluted),	60 min.
Syrup of Squill,	2 fl. dr.
Water, sufficient to make	2 fl. oz.

Mix. Dose for an adult, a tablespoonful.

243. Lotio Adstringens. *N. F.*

Astringent Lotion.

Warren's Styptic.

Sulphuric Acid,	5 fl. dr.
Oil of Turpentine,	4 fl. dr.
Alcohol,	4 fl. dr.

To the Sulphuric Acid, contained in a Wedgwood mortar, slowly add the Oil of Turpentine, in small portions at a time, constantly stirring. Allow the mixture to cool, then add the Alcohol cautiously, in the same manner, and continue stirring until no more fumes arise. When the liquid is cold, pour it into a glass-stoppered bottle.

Note.—In preparing this mixture, caution should be used, so that the temperature may not rise too high. Particular care is to be observed if a larger quantity of this mixture is to be prepared. In this case it is preferable to prepare it in several portions.

265. Mistura Sulphurica Acida. *N. F.*

Sulphuric Acid Mixture.

Mixtura Sulphurica Acida (*Germ. Pharm.*).
Haller's Acid Elixir.

Sulphuric Acid,	1 part.
Alcohol,	enough to make 4 parts.

Add the Acid very gradually to *three* (3) *parts* of Alcohol, contained in a flask, agitating after each addition, and taking care that the temperature of the mixture be not allowed to rise above 50° C. (122° F.). When the mixture is cold, add enough Alcohol, if necessary, to make *four* (4) *parts*.

Note.—The same product may be obtained, approximately, by carefully and slowly adding 1 volume of Sulphuric Acid to 7 volumes of Alcohol, and this method may be used when small quantities are required for immediate use in a prescription.

4. Acidum Metaphosphoricum Dilutum. *N. F.*

Diluted Metaphosphoric Acid.

Acidum Phosphoricum Glaciale Dilutum. Diluted Glacial Phosphoric Acid.

Glacial Phosphoric Acid,	780 gr.
Distilled Water, enough to make	16 fl. oz.

Dissolve the Acid in the Water, without heat.

This preparation should be kept in a cool and dark place, and should not be prepared in larger quantity than may be consumed within a few months.

Note.—The resulting product contains about 10 per cent. of metaphosphoric acid, provided the glacial acid was free from impurities. That which is sold in form of glassy lumps is usually of sufficient purity. The variety in form of round sticks is more or less impure, containing generally more than 15 per cent. of phosphate of sodium. If this variety is alone available, a proportionately larger quantity must be taken, to be determined, if time permits, by an assay of the free acid present. If no special accuracy is required, about 900 grains of this variety of the acid may be reckoned to be equivalent to the quantity directed in the above given formula.

Whenever Pyrophosphate of Iron (U. S. P.) forms one of the ingredients of a mixture containing Diluted Phosphoric Acid, the officinal tribasic acid is unsuitable, as it produces with the salt a gelatinous precipitate. If a clear mixture is required, the above preparation is to be used in place of the officinal. The same may be done when Phosphate of Iron (U.S.P.) is prescribed, though the precipitate caused by the officinal acid in this case is not as bulky, and under certain conditions may not form at all.

Boric Acid Cotton.

Purified Cotton Wool, sufficient.	
Boric Acid,	60 gr.
Water,	9 fl. dr.

Dissolve the Boric Acid in the Water at a temperature of 60° C. (140° F.); saturate the Purified Cotton with this solution, press it, dry it, and preserve in wide-mouth, cork-stoppered vials.

Boric Acid Ointment.

(Lister's.)

Boric Acid,	240 gr.
White Wax,	240 gr.
Paraffin,	1 oz. (troy).
Almond Oil,	1 fl. oz.

Mix.

Boric Acid Ointment.

Boroglyceride,	2 fl. dr.
White Wax,	240 gr.
Vaseline,	8 fl. oz.

Heat the Wax and Vaseline together, and while hot add the Glyceride slowly; use constant stirring while cooling.

10. Boroglycerinum. *N. F.*

Boroglycerin.

Glyceryl Borate. Boroglyceride.

Boric Acid, in powder,	62 parts.
Glycerin,	92 parts.

Heat the Glycerin in a tared porcelain capsule to a temperature not exceeding 150° C. (302° F.), and add the Boric Acid in portions, constantly stirring. When all is added and dissolved, continue the heat at the same temperature, frequently stirring, and breaking up the film which forms on the surface. When the mixture has become reduced to a weight of *one hundred* (100) *parts*, pour it out on a flat surface previously coated with a very small quantity of petrolatum, let it cool, cut it into pieces and transfer them immediately to bottles or jars, which should be well stoppered.

Note.—When a solution of Boroglycerin is required, it is preferable to prescribe or to dispense the Glycerite of Boroglycerin. (See *Glyceritum Boroglycerini*, No. 184, next formula.)

184. Glyceritum Boroglycerini. *N. F.*

Glycerite of Boroglycerin.

Glycerite of Glyceryl Borate. Solution of Boroglyceride.

Boric Acid, in powder,	62 parts.
Glycerin, enough to make	200 parts.

Heat *ninety-two* (92) *parts* of Glycerin in a tared porcelain capsule to a temperature not exceeding 150° C. (302° F.), and add the Boric Acid, in portions, constantly stirring. When all is added and dissolved, continue the heat at the same temperature, frequently stirring, and breaking up the film which forms on the surface. When the mixture has been reduced to the weight of *one hundred* (100) *parts*, add to it *one hundred* (100) *parts* of Glycerin, mix thoroughly, and transfer it to suitable vessels.

Two parts, by weight, of this preparation represent* 1 *part of solid Boroglycerin.

Note.—The product, which is a clear, viscid liquid, is more readily soluble in, and miscible with, other liquids than the solid Boroglycerin. (See *Boroglycerinum*.)

It may be found more convenient, if the glycerite is needed immediately, to place one ounce (av.) of boroglyceride in a dish and add one ounce (av.) of glycerin, heating gently and stirring until it is dissolved.

BROMINE.

Antidote to the Poison of the Rattlesnake.

(Bibron's.)

Bromine,	150 gr.
Potassium Iodide,	2 gr.
Corrosive Chloride of Mercury,	1 gr.
Diluted Alcohol,	4 fl. oz.

Dissolve. Take 10 drops in a tablespoonful of brandy, repeated as required.

Bromine Inhalation.

(Netolitzky's.)

Bromine,	16 gr.
Potassium Bromide,	16 gr.
Distilled Water,	7 fl. oz.

Dissolve. To be poured, a small quantity at a time, upon a sponge or lint for inhalation in croup.

Solution of Bromine.

(Dr. J. Lawrence Smith's.)

Bromine,	240 gr.
Potassium Bromide,	80 gr.
Distilled Water,	2 fl. oz.

Dissolve the Potassium Bromide in about 1 fl. oz. of the Distilled Water, add the Bromine, agitate, and finally add the remainder of the Distilled Water. It should be kept in small, ground-stoppered vials. Dose, 1 to 2 drops.

208. Liquor Bromi. *N. F.*

Solution of Bromine.

Smith's Solution of Bromine.

Bromine,	1 tr. oz.
Bromide of Potassium,	½ tr. oz.
Water,	4 fl. oz.

Dissolve the Bromide of Potassium in the Water contained in a bottle, add the Bromine, and shake the mixture until this is dissolved. Keep the solution in glass-stoppered vials in a dark place.

Note.—As bromine vapor is very injurious to the respiratory passages and destructive to balances, it is often preferable to take the contents of an original bottle of Bromine—weighing the bottle, both before opening it and after emptying it, in order to ascertain the exact weight of the Bromine contained therein—and then to use a quantity of Bromide of Potassium and of Water proportionate to the quantities above given.

IODINE.

Iodized Glycerin.

Iodized Oil of Bitter Almond,	1 fl. dr.
Glycerin,	7 fl. dr.

Mix. See next formula.

Iodized Oil of Bitter Almond.

Iodine,	20 gr.
Oil of Bitter Almond,	1 fl. dr.

Mix, and shake occasionally for two months.

Unguentum Iodinii Compositum. *U. S.* 1870. COMPOUND IODINE OINTMENT.

Iodine,	15 gr.
Iodide of Potassium,	30 gr.
Water,	30 min.
Lard,	1 oz. (troy).

Dissolve the Iodine and Iodide of Potassium in the Water, then incorporate the solution with the Lard.

Iodinal Collodion.

(J. T. Shinn's.)

Iodine,	120 gr.
Canada Turpentine,	2 fl. dr.
Collodion,	8 fl. oz.

Dissolve the Iodine and Turpentine in the Collodion. Used as a substitute for Iodine Ointment.

196. Linimentum Iodi. *N. F.*

Iodine Liniment.

Iodine,	900 gr.
Iodide of Potassium,	360 gr.
Glycerin,	½ fl. oz.
Water,	1 fl. oz.
Alcohol, enough to make	16 fl. oz.

Mix *thirteen* (13) *fluidounces* of Alcohol with the other ingredients, and dissolve the solids by agitation. Then add enough Alcohol to make *sixteen* (16) *fluidounces.*

Note.—The proportion of the ingredients above given yields a product practically identical with that prescribed by the Br. Pharm.

Iodized Phenol.

(Battey's formula.)

Iodine,	240 gr.
Carbolic Acid,	1 fl. oz.

Mix. It is to be diluted generally with equal parts of Glycerin, and applied twice a day.

Tinctura Iodinii Composita. *U. S.* 1870.

COMPOUND TINCTURE OF IODINE.

Iodine,	240 gr.
Iodide of Potassium,	1 oz. (troy).
Alcohol,	16 fl. oz.

Dissolve the Iodine and Iodide of Potassium in the Alcohol.

Iodine Solution.

(Magendie's.)

Potassium Iodide,	240 gr.
Iodine,	2 gr.
Peppermint Water,	6 fl. oz.

Dissolve. Dose, a teaspoonful.

222. Liquor Iodi Causticus. *N. F.*

Caustic Solution of Iodine.

Iodine Caustic. Churchill's Iodine Caustic.

Iodine,	1 tr. oz.
Iodide of Potassium,	2 tr. oz.
Water,	4 fl. oz.

Dissolve the Iodide of Potassium and the Iodine in the Water.

350. Syrupus Acidi Hydriodici Decolor. *N. F.*

Colorless Syrup of Hydriodic Acid.

Iodide of Potassium,	128 gr.
Hypophosphite of Potassium,	8 gr.
Tartaric Acid,	112 gr.
Water,	½ fl. oz.
Diluted Alcohol,	1 fl. oz.
Syrup, enough to make	16 fl. oz.

Dissolve the Iodide and Hypophosphite of Potassium in *one-half* (½) *fluidounce* of Water, and the Tartaric Acid in *one-half* (½) *fluidounce* of Diluted Alcohol. Mix the two solutions in a vial, cork and shake it well, and then place it in ice-water for about half an hour, or longer, if convenient; again shake it thoroughly, and then pour the mixture upon a small white filter contained in a funnel, the stem of

which dips below the surface of *fourteen* (14) *fluidounces* of Syrup contained in a bottle. When the liquid has run through, wash the vial and filter with *one-half* (½) *fluidounce* of Diluted Alcohol, added in several portions. Then add enough Syrup to make *sixteen* (16) *fluidounces*. Keep the product in well-stoppered bottles.

Note.—This preparation is of about the same strength, volume for volume, but not weight for weight, as the officinal *Syrupus Acidi Hydriodici*.

221. Liquor Iodi Carbolatus. *N. F.*

Carbolized Solution of Iodine.

Boulton's Solution. French Mixture.

Compound Solution of Iodine,	110 min.
Carbolic Acid, liquefied by a gentle heat,	40 min.
Glycerin,	2½ fl. oz.
Water,	enough to make 16 fl. oz.

Mix the Glycerin with the Carbolic Acid and Compound Solution of Iodine, add enough Water to make *sixteen* (16) *fluidounces*, and expose the mixture to sunlight until it has become colorless.

357. Syrupus Calcii Iodidi. *N. F.*

Syrup of Iodide of Calcium.

Iodine,	552 gr.
Iron Wire, fine, bright, and finely cut,	200 gr.
Precipitated Carbonate of Calcium,	250 gr.
Distilled Water,	a sufficient quantity.
Sugar,	11 tr. oz.
Syrup,	enough to make 16 fl. oz.

Mix the Iron Wire with *four hundred and fourteen* (414) *grains* of the Iodine and *three* (3) *fluidounces* of Distilled Water, and apply a gentle heat, until the Iodine is combined and the liquid has acquired a greenish color. Filter the liquid through a small filter into a flask containing the remainder of the Iodine, wash the filter with *one* (1) *fluidounce* of Distilled Water, and heat the solution gently, taking care that no Iodine is lost by evaporation. Heat *four* (4) *fluidounces* of Distilled Water in a capacious capsule to boiling, and add to it small alternate portions, first of the Precipitated Carbonate of Calcium, and then of the solution of Iodide of Iron, in small portions at a time, stirring briskly and waiting until the violence of the reaction moderates before adding a fresh portion. From time to time add a little Distilled Water, to replace that lost by evaporation. When all the Iron solution has been added, continue heating the mixture until it is quietly boiling, then filter it through a wetted filter, and wash the latter with enough Distilled Water to make the product, when cold, measure *eight* (8) *fluidounces*. In this dissolve the Sugar by agitation, then make up the volume with Syrup to *sixteen* (16) *fluidounces*, and strain, if necessary.

Each fluidrachm contains about 5 grains of Iodide of Calcium.

Iodine Caustic.

(Riesberg's.)

Iodine,	1 oz. (troy).
Glycerin,	2 fl. oz.

Applied every second day with a brush. As the preparation is very powerful, its effect must be watched.

Coster's Paste.

Iodine Pigment,	120 gr.
Oil of Cade,	1 oz. (troy).

Mix. For an embrocation. This preparation should not be used until it has stood four weeks. The Iodine Pigment is made by dissolving 60 gr. of Iodine in 1 fl. oz. of Alcohol, and allowing the solution to stand in a glass bottle for several months before use.

Iodized Cotton.

Iodine,	60 gr.
Purified Cotton,	1½ fl. oz.

Enclose the Iodine in filtering-paper, and place it at the bottom of a flask with a wide mouth; then introduce the Cotton, and close the flask by covering the mouth. Place the flask in a moderately warm place until the Cotton appears to be uniformly colored by the Iodine.

400. Tinctura Iodi, Churchill. *N. F.*

Churchill's Tincture of Iodine.

Iodine,	2¼ tr. oz.
Iodide of Potassium,	¾ tr. oz.
Water,	4 fl. oz.
Alcohol,	enough to make 16 fl. oz.

Dissolve the Iodide of Potassium in the Water, then add the Iodine, and, lastly, enough Alcohol to make the Tincture, when completed, measure *sixteen* (16) *fluidounces*.

Note.—Churchill's Tincture of Iodine should not be confounded with Churchill's Iodine Caustic (*Liquor Iodi Causticus*, No. 222, page).

401. Tinctura Iodi Decolorata. *N. F.*

Decolorized Tincture of Iodine.

Iodine,	610 gr.
Hyposulphite of Sodium,	610 gr.
Water,	1½ fl. oz.
Stronger Water of Ammonia (U. S. P.),	1 fl. oz.
Alcohol,	enough to make 16 fl. oz.

Digest the Iodine, Hyposulphite of Sodium, and Water, at a gentle heat, until a perfect solution, of a dark reddish-brown color, is produced. Then add *two* (2) *fluidounces* of Alcohol, and afterwards the Stronger Water of Ammonia. Shake a few minutes until no more bubbles of gas escape and the liquid has become colorless,

with a whitish precipitate (of sulphur) suspended in it. Cool it, if necessary, and add enough Alcohol to make *sixteen* (16) *fluidounces*. Place the bottle containing it in a refrigerator for a few hours, or longer, if convenient, then filter, in a covered funnel, and preserve the liquid for use.

Note.—On prolonged standing a crystalline precipitate of tetrathionate of sodium will usually form in the liquid. This may be removed by filtration.

Ethereal Tincture of Iodine.

(Magendie's.)

Iodine,	32 gr.
Ether,	1 fl. oz.

Dissolve. Used externally.

SULPHUR.

Unguentum Sulphuris Iodidi. *U. S.* 1870. OINTMENT OF IODIDE OF SULPHUR.

Iodide of Sulphur,	30 gr.
Prepared Lard,	1 oz. (troy).

Triturate the Iodide of Sulphur in a porcelain mortar, and gradually add the Lard, rubbing them together until the ointment is perfectly smooth and free from grittiness.

Vleminckx's Solution.

Lime,	240 gr.
Sublimed Sulphur,	1 oz. (troy).
Water,	10 fl. oz.

Boil down to 6 fl. oz. and filter. Used externally in acne.

423. Unguentum Sulphuris Compositum. *N. F.*

Compound Sulphur Ointment.

Wilkinson's Ointment. Hebra's Itch Ointment.

Precipitated Carbonate of Calcium,	10 parts.
Sublimed Sulphur,	15 parts.
Oil of Cade,	15 parts.
Green Soap,	30 parts.
Lard,	30 parts.

Mix the Lard with the Green Soap and Oil of Cade. Then gradually incorporate the Sublimed Sulphur and Precipitated Carbonate of Calcium.

PHOSPHORUS.

Syrup of the Hypophosphites.

(Parrish's.)

Calcium Hypophosphite,	360 gr.
Sodium Hypophosphite,	120 gr.
Potassium Hypophosphite,	120 gr.
Sugar,	13 oz. (troy).
Hot Water,	10 fl. oz.
Orange Flower Water,	4 fl. dr.

Dissolve the salts in the Hot Water, filter through paper, dissolve the Sugar in the solution by the aid of heat, strain, and add the Orange-Flower Water. Dose, a teaspoonful, containing nearly 5 gr. of the mixed salts.

Compound Solution of the Hypophosphites of Iron, Soda, Lime, and Magnesium.

Calcium Hypophosphite,	11 oz. 80 gr. av.
Oxalic Acid,	1¼ oz. av.
Ferrous Sulphate,	2 oz. av. 260 gr.
Sodium Sulphate,	5 oz. av. 120 gr.
Magnesium Sulphate,	1 oz. av. 420 gr.
Boiling Water,	5 pints.
Water, a sufficient quantity to make	100 fl. oz.

Dissolve the Calcium Hypophosphite in the Boiling Water, add the Oxalic Acid, stirring for a minute, and then the other ingredients in the order given. Agitate for two or three minutes, allow the mixture to become cold, filter into a bottle marked 100 fl. oz., and wash the Calcium Oxalate and Sulphate, which remain on the filter, with Water until 100 fl. oz. of liquid are obtained.

377. Syrupus Phosphatum Compositus.

Compound Syrup of the Phosphates.

Chemical Food.

Precipitated Carbonate of Calcium,	256 gr.
Phosphate of Iron (U. S. P. 1880),	128 gr.
Phosphate of Ammonium,	128 gr.
Bicarbonate of Potassium,	32 gr.
Bicarbonate of Sodium,	32 gr.
Citric Acid,	1 tr. oz.
Glycerin,	1 fl. oz.
Phosphoric Acid (50 per cent.),	2 fl. oz.
Orange-Flower Water,	2 fl. oz.
Tincture of Cudbear (N. F.),	120 min.
Sugar,	8 tr. oz.
Water,	enough to make 16 fl. oz.

Triturate the Precipitated Carbonate of Calcium with the Bicarbonates of Potassium and Sodium, the Citric Acid, Glycerin, and Orange-Flower Water, and gradually add the Phosphoric Acid, stirring until solution has been effected. Dissolve the Phosphate of Iron and the Phosphate of Ammonium in *four* (4) *fluidounces* of hot Water, cool, and add the solution to that previously prepared. Filter the whole through a pellet of absorbent cotton placed in the neck of a funnel, and receive the filtrate in a graduated bottle containing the Sugar. Agitate until the latter is dissolved, then add the Tincture of Cudbear, and, lastly, enough Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains about 2 grains of Phosphate of Calcium, 1 grain, each, of the Phosphates of Iron and Ammonium, and smaller quantities of the Phosphates of Potassium and Sodium.

Solution of the Hypophosphites.

(Hayes's.)

Calcium Hypophosphite,	128 gr.
Potassium Hypophosphite,	128 gr.
Sodium Hypophosphite,	32 gr.
Quinine Hypophosphite,	32 gr.
Manganese Hypophosphite,	32 gr.
Iron Hypophosphite,	64 gr.
Strychnine Hypophosphite,	1 gr.
Glycerin,	384 min.
Solution of Hypophosphorous Acid,	256 min.
Water, sufficient to make	16 fl. oz.

Dissolve.

3. Acidum Hypophosphorosum Dilutum. ***N. F.***

Diluted Hypophosphorous Acid.

Hypophosphite of Potassium,	208 parts.
Tartaric Acid,	300 parts.
Distilled Water,	588 parts.
Diluted Alcohol,	600 parts.

Dissolve the Hypophosphite of Potassium in the Distilled Water, and the Tartaric Acid in the Diluted Alcohol. Mix the two solutions in a flask, cork the latter well, and put it aside in a cold place during twelve hours. Then carefully decant the liquid into a funnel, the neck of which contains a pellet of absorbent cotton, or, if necessary, pass the liquid through a filter, care being taken that it shall not suffer loss by evaporation. Weigh the filtrate, which contains *ten* (10) *per cent.* of hypophosphorous acid, in a tared capsule, and evaporate the alcohol by means of a water-bath, at a temperature not exceeding 60° C. (140° F.). Then allow the liquid to cool, and add enough Distilled Water to restore the original weight of the filtrate. Preserve the product in well-stoppered bottles.

Note.—Hypophosphorous Acid thus prepared contains 10 per cent. of absolute hypophosphorous acid (H_3PO_2), and has a specific gravity of 1·060 at 15° C. (59° F.). If the acid is required for immediate use, and the presence of alcohol is not objectionable, the mixture of the two solutions need be cooled only a short time, and the filtrate may be used at once. If a 50 per cent. acid is required, the concentration may be cautiously continued until the desired percentage has been attained. A 50 per cent. acid has a specific gravity of about 1·406 at 15° C. (59° F.).

76. Elixir Hypophosphitum cum Ferro. ***N. F.***

Elixir of Hypophosphites with Iron.

Hypophosphite of Calcium,	188 gr.
Hypophosphite of Sodium,	128 gr.
Hypophosphite of Potassium,	64 gr.
Sulphate of Iron, in clear crystals,	96 gr.
Citric Acid,	30 gr.
Water,	4 fl. oz.
Syrup,	4 fl. oz.
Aromatic Elixir, enough to make	16 fl oz.

Dissolve the Hypophosphites in *three* (3) *fluidounces* of Water, and add the Syrup. Dissolve the Sulphate of Iron in the remainder of the Water, and mix this with the other solution. Then add *six* (6) *fluidounces* of Aromatic Elixir, set the mixture aside, in a cold place, for twelve hours, and filter from the deposited sulphate of calcium. Finally, dissolve the Citric Acid in the filtrate, and pass enough Aromatic Elixir through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm contains about ½ grain of Hypophosphite of Iron (ferrous), about 1 grain, each, of the Hypophosphites of Calcium and Sodium, and ½ grain of Hypophosphite of Potassium.

229. Liquor Hypophosphitum. ***N. F.***

Solution of Hypophosphites.

Hypophosphite of Calcium,	256 gr.
Hypophosphite of Sodium,	160 gr.
Hypophosphite of Potassium,	128 gr.
Citric Acid,	120 gr.
Water, enough to make	16 fl. oz.

Dissolve the salts and the Citric Acid in Water so as to make *sixteen* (16) *fluidounces;* filter, if necessary, and pass enough Water through the filter to restore the original volume.

Each fluidrachm contains 2 *grains of Hypophosphite of Calcium,* 1¼ *grain of Hypophosphite of Sodium, and* 1 *grain of Hypophosphite of Potassium.*

75. Elixir Hypophosphitum. ***N. F.***

Elixir of Hypophosphites.

Hypophosphite of Calcium,	384 gr.
Hypophosphite of Sodium,	128 gr.
Hypophosphite of Potassium,	128 gr.
Citric Acid,	30 gr.
Water,	4 fl. oz.
Glycerin,	½ fl. oz.
Compound Spirit of Cardamom,	½ fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Hypophosphites and the Citric Acid in the Water; then add the Glycerin, Compound Spirit of Cardamom, and enough Aromatic Elixir to make *sixteen* (16) *fluidounces.* Filter, if necessary.

Each fluidrachm contains 3 grains of Hypophosphite of Calcium and 1 grain, each, of the Hypophosphites of Sodium and Potassium.

Solution of Phosphates.

(Dr. Pepper's.)

Calcium Phosphate,	6 gr.
Magnesium Phosphate,	4 gr.
Potassium Phosphate,	3 gr.
Phosphoric Acid (Concent.),	10 min.
Water, sufficient to make	2 fl. dr.

Make a solution and filter.

370. Syrupus Hypophosphitum Compositus. N. F.

Compound Syrup of Hypophosphites.

Compound Hypophosphites.

Hypophosphite of Calcium,	256 gr.
Hypophosphite of Potassium,	128 gr.
Hypophosphite of Sodium,	128 gr.
Hypophosphite of Iron,	16 gr.
Hypophosphite of Manganese,	16 gr.
Citrate of Potassium,	40 gr.
Citric Acid,	15 gr.
Hydrochlorate of Quinine,	8 gr.
Tincture of Nux Vomica (U.S.P.),	160 min.
Sugar,	12 tr. oz.
Water, enough to make	16 fl. oz.

Rub the Hypophosphites of Iron and of Manganese with the Citrate of Potassium and Citric Acid to powder, add *one* (1) *fluidounce* of Water, and warm the mixture a few minutes until a clear greenish solution is obtained. Introduce the other Hypophosphites and the Hydrochlorate of Quinine, previously triturated together, into a graduated bottle, next add the Sugar, the Iron and Manganese solution first prepared, the Tincture of Nux Vomica, and, lastly, enough Water to make up the volume, as soon as the Sugar is saturated by the liquid, to *sixteen* (16) *fluidounces*. Agitate until solution has been effected, and strain, if necessary.

Each fluidrachm contains 2 grains of Hypophosphite of Calcium, 1 grain, each, of the Hypophosphites of Potassium and Sodium, ⅛ grain, each, of the Hypophosphites of Iron and of Manganese, 1/16 grain of Hydrochlorate of Quinine, and 1¼ minims of Tincture of Nux Vomica.

Note.—This Syrup should not be confounded with the officinal *Syrupus Hypophosphitum* (Syrup of the Hypophosphites).

355. Syrupus Calcii et Sodii Hypophosphitum. N. F.

Syrup of Hypophosphite of Calcium and Sodium.

Syrup of Hypophosphite of Lime and Soda.

Hypophosphite of Calcium,	256 gr.
Hypophosphite of Sodium,	256 gr.
Citric Acid,	10 gr.
Sugar,	12 tr. oz.
Water, enough to make	16 fl. oz.

Dissolve the two Hypophosphites and the Citric Acid in *eight* (8) *fluidounces* of Water, filter the solution, add the Sugar to the filtrate, and pass enough Water through the filter to make the product, after the Sugar has been dissolved by agitation, measure *sixteen* (16) *fluidounces*.

Each fluidrachm contains 2 grains, each, of Hypophosphite of Calcium and Hypophosphite of Sodium.

101. Elixir Sodii Hypophosphitis. N. F.

Elixir of Hypophosphite of Sodium.

Hypophosphite of Sodium,	256 gr.
Citric Acid,	30 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Hypophosphite of Sodium and the Citric Acid in about *twelve* (12) *fluidounces* of Aromatic Elixir, by agitation. Then add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm contains 2 grains of Hypophosphite of Sodium.

356. Syrupus Calcii Hypophosphitis. N. F.

Syrup of Hypophosphite of Calcium.

Syrup of Hypophosphite of Lime.

Hypophosphite of Calcium,	256 gr.
Citric Acid,	10 gr.
Sugar,	12 tr. oz.
Water, enough to make	16 fl. oz.

Dissolve the Hypophosphite of Calcium and the Citric Acid in *eight* (8) *fluidounces* of Water, filter the solution, add the Sugar to the filtrate, and pass enough Water through the filter to make the product, after the Sugar has been dissolved by agitation, measure *sixteen* (16) *fluidounces*.

Each fluidrachm contains 2 grains of Hypophosphite of Calcium.

228. Liquor Phosphori. N. F.

Solution of Phosphorus.

Thompson's Solution of Phosphorus.

Phosphorus,	1 gr.
Absolute Alcohol,	450 min.
Spirit of Peppermint,	10 min.
Glycerin,	2 fl. oz.

Dissolve the Phosphorus in *four hundred* (400) *minims* of Absolute Alcohol, in a stoppered vial or test-tube, by immersion in a water-bath and frequent agitation, taking care that any loss of Alcohol, by evaporation, be made up from time to time. Allow the solution to become nearly cold, and then add to it the remainder of the Absolute Alcohol and the Glycerin, previously mixed and slightly warmed. Finally, add the Spirit of Peppermint. Keep the solution in a well-stoppered bottle, in the dark.

Each fluidrachm contains about 1/24 grain of Phosphorus.

Note.—This solution must not be confounded with the *Spiritus Phosphori* (No. 344), which is not intended to be administered as such, but is only to be used in compounding the Elixir or other preparations of phosphorus.

The Phosphorus should be perfectly translucent, cut and weighed under water, and quickly dried with filtering paper before being dropped into the alcohol.

Compound Syrup of Hypophosphites.

(Containing Ferric Hypophosphite. Procter's.)

Calcium Hypophosphite,	256 gr.
Sodium Hypophosphite,	192 gr.
Potassium Hypophosphite,	128 gr.
Ferric Hypophosphite,	96 gr.
Hypophosphorous Acid Solution,	240 min.
Sugar,	9 oz. (av.).
Extract of Vanilla,	4 fl. dr.
Water, sufficient.	

Dissolve the salts of Calcium, Sodium, and Potassium in 6 fl. oz. of Water; put the Iron salt in a mortar, and gradually add solution of Hypophosphorous Acid till it is dissolved; to this add the solution of the other salts, after it has been rendered slightly acidulous with the same acid, and then Water, till the whole measures 12 fl. oz. Dissolve in this the Sugar, with heat, and add the Vanilla. Dose, a teaspoonful.

85. Elixir Phosphori. *N. F.*

Elixir of Phosphorus.

Spirit of Phosphorus,	8¾ fl. oz.
Oil of Star-anise,	16 min.
Glycerin,	9 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

To the Spirit of Phosphorus add the Oil of Star-anise and Glycerin, and shake gently until they form a clear liquid. Then add the Aromatic Elixir; in small portions at a time, gently agitating after each addition, until a clear mixture results.

Keep the product in dark amber-colored vials, in a cool and dark place. It should not be prepared in quantities larger than will be consumed within a few months.

Each fluidrachm contains $\frac{1}{50}$ grain of Phosphorus.

86. Elixir Phosphori et Nucis Vomicæ. *N. F.*

Elixir of Phosphorus and Nux Vomica.

Tincture of Nux Vomica,	256 min.
Elixir of Phosphorus, enough to make	16 fl. oz.

Mix them. This preparation should be freshly made, when wanted for use.

Each fluidrachm represents 2 minims of Tincture of Nux Vomica and nearly $\frac{1}{50}$ grain of Phosphorus.

344. Spiritus Phosphori. *N. F.*

Spirit of Phosphorus.

Tincture of Phosphorus.

Phosphorus,	10 gr.
Absolute Alcohol, enough to make	15 fl. oz.

To the Absolute Alcohol, contained in a flask, add the Phosphorus, cut into small pieces, and apply a moderate heat, by means of a water-bath, taking care to prevent, as much as possible, any loss of alcohol by evaporation, or making up any loss by adding, from time to time, a little more Absolute Alcohol. When the Phosphorus is dissolved, allow the liquid to become cold, and add enough Absolute Alcohol, if necessary, to make *fifteen* (15) *fluidounces.* Then transfer the Spirit to small, dark amber-colored vials, stopper them securely, and keep them in a cool and dark place.

Each fluidrachm contains $\frac{1}{72}$ grain of Phosphorus; or 14·4 minims contain $\frac{1}{50}$ grain of Phosphorus.

Note.—The Phosphorus should be perfectly translucent, cut and weighed under water, and quickly dried with filtering paper before being dropped into the Alcohol. The loss of Alcohol, during the heating, may be avoided, and solution effected more expeditiously, by attaching to the flask a well-cooled upright condenser, which will cause the vapor of the alcohol to be condensed, and to flow back into the flask. In the absence of a condenser, a long glass tube, inserted through a tight-fitting cork into the neck of the flask, and maintained in an upright condition, will nearly answer the same purpose.

This preparation is intended for preparing the Elixir of Phosphorus (see No. 85). It is unsuited for internal administration without corrigents. Care should be taken that it be not confounded with Thompson's Solution of Phosphorus. (See *Liquor Phosphori*, No. 228.)

Compound Solution of Phosphates.

Calcium Carbonate,	869 gr.
Magnesia (Calc.),	29 gr.
Potassium Carbonate,	25 gr.
Iron Phosphate,	64 gr.
Phosphoric Acid (60 per cent.),	1705 gr.
Water, sufficient to make	16 fl. oz.

Mix the Acid with half a pint of Water, add the Iron Phosphate, and stir until dissolved; then add gradually the Calcium Carbonate, stirring until effervescence ceases and the freshly-formed Phosphate is dissolved, and finally add the Magnesia and Potassium Carbonate; stir until dissolved, and make up the measure to 1 pint. Used as an *acid phosphate.*

202. Liquor Acidi Phosphorici Compositus. *N. F.*

Compound Solution of Phosphoric Acid.

Solution of Acid Phosphates.

Bone Ash, in fine powder,	100 parts.
Sulphuric Acid,	78 parts.
Water,	400 parts.

Mix the Bone Ash with *one hundred* (100) *parts* of Water, add the Sulphuric Acid, diluted with *two hundred* (200) *parts* of Water, and mix thoroughly with a porcelain or glass stirrer. Now add the remainder of the Water and set the mixture aside for twenty-four hours, stirring occasionally. Then transfer the mixture

to a strong muslin strainer, and subject this to a gradual pressure (avoiding contact with metals), so as to express as much of the liquid as possible. Lastly, filter this through paper.

The specific gravity of this solution is about 1·113 at 15° C. (59° F.).

Note.—The quantity of product obtained depends on the degree of force used in pressing. By strong pressure, about 350 parts may be obtained. If desired, the magma may also be poured in a glass percolator, the neck of which contains a layer of fine quartz sand or asbestos, previously deprived of matters soluble in sulphuric or phosphoric acid. On cautiously pouring water on top, so as not to mix it with the magma, the acid solution will be displaced. But the percolation must be interrupted as soon as the specific gravity of the percolate begins to fall below 1·113. The Sulphuric Acid used in this preparation may be the commercial variety, provided it is free from arsenic, and of a specific gravity not less than 1·830.

POTASSIUM SALTS.

Effervescing Draught.

Potassium Bicarbonate,	80 gr.
Water,	2 fl. oz.

Make a solution. Take a tablespoonful of lemon-juice diluted with a tablespoonful of Water, and add to it in a tumbler a tablespoonful of this solution, then drink immediately.

Muller's Fluid.

Potassium Bichromate,	200 gr.
Sodium Sulphate,	80 gr.
Water,	16 fl. oz.

Brown-Séquard's Anti-Epileptic Mixture.

Sodium Bromide,	180 gr.
Potassium Bromide,	180 gr.
Ammonium Bromide,	180 gr.
Potassium Iodide,	90 gr.
Ammonium Iodide,	90 gr.
Ammonium Carbonate,	60 gr.
Tincture of Calumba,	1½ fl. oz.
Water, sufficient to make	8 fl. oz.

Mix. Adult dose, 1½ teaspoonfuls before each meal, and 3 teaspoonfuls at bedtime.

Whooping-Cough Remedy.

(Dr. J. J. Caldwell's.)

Ammonium Bromide,	20 gr.
Potassium Bromide,	40 gr.
Fluid Extract of Belladonna,	6 min.
Distilled Water,	2 fl. oz.

Used with steam atomizer for ten to fifteen minutes morning, noon, and bedtime.

Pancoast's Styptic.

Potassium Carbonate,	120 gr.
Soap,	30 gr.
Alcohol,	1 fl. oz.

Mix.

Antidiphtheritic Mixture.

(Warren's.)

Thymol,	4 gr.
Potassium Chlorate,	75 gr.
Quinine Sulphate,	45 gr.
Hydrochloric Acid,	15 min.
Glycerin,	2 fl. oz.
Brandy,	9 fl. oz.

Dose, a teaspoonful every hour for children between two and five years.

Laxative Powder.

(Jeannel's.)

Potassium and Sodium Tartrate,	600 gr.
Sodium Bicarbonate,	240 gr.
Tartaric Acid,	240 gr.
Oil of Lemon, sufficient.	
Sugar,	2½ oz. (troy).

Dose, a teaspoonful in sweetened water.

306. Potassii Citras Effervescens. *N. F.*

Effervescent Citrate of Potassium.

Citrate of Potassium,	200 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	460 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) grains (or about a heaped teaspoonful) of the above compound represent 10 grains of Citrate of Potassium.

230. Liquor Potassæ Chloratæ. *N. F.*

Solution of Chlorinated Potassa.

Liquor Potassæ Chlorinatæ. Javelle Water.

Carbonate of Potassium,	58 parts.
Chlorinated Lime (U. S. P.),	80 parts.
Water, enough to make	1000 parts.

Mix the Chlorinated Lime, contained in a tared flask, with *four hundred* (400) *parts* of Water. Dissolve the Carbonate of Potassium in *three hundred* (300) *parts* of boiling Water, and pour the hot solution into the mixture first prepared. Shake the flask well, stopper it, set it aside to cool, and then add enough Water to make the contents weigh *one thousand* (1000) *parts.* Allow the suspended matters to subside, and remove the clear solution by means of a siphon, or by straining through muslin. Keep the product in well-stoppered bottles.

Note.—The Chlorinated Lime should contain not less than 25 per cent. of available chlorine.

231. Liquor Potassii Arseniatis et Bromidi. *N. F.*

Solution of Arseniate and Bromide of Potassium.

Liquor Arsenii Bromidi. Solution of Bromide of Arsenic. Clemens' Solution.

Arsenious Acid,	78 gr.
Bicarbonate of Potassium,	78 gr.
Bromine,	117 gr.
Water, enough to make	16 fl. oz.

Boil the Arsenious Acid with the Bicarbonate of Potassium and *two* (2) *fluidounces* of Water until solution is effected. Allow this to cool, add *ten* (10) *fluidounces* of Water, then the Bromine, and afterwards enough Water to make *sixteen* (16) *fluidounces*. Let the mixture stand a few hours, agitating it occasionally, then filter.

This solution contains an amount of Arsenic in combination, corresponding to about 1 *per cent. of Arsenious Acid.*

Note.—The title "Solution of Bromide of Arsenic" (*Liquor Arsenii Bromidi*), which is often applied to Clemens' Solution or similar preparations, is a misnomer, since bromide of arsenic cannot exist, as such, in presence of water, but is split up into hydrobromic and arsenious acids. The proportions of the ingredients, in the formula above given, have been adjusted, as closely as practicable, so as to yield definite compounds, viz., arseniate and bromide of potassium.

In order to prevent injury to the balances by weighing a definite amount of Bromine, the plan suggested in the Note to No. 208 may be applied to this preparation, viz., to prepare such a quantity of the latter at one time as will be commensurate to the actual contents of an original vial of Bromine.

89. Elixir Potassii Acetatis. *N. F.*

Elixir of Acetate of Potassium.

Acetate of Potassium,	640 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Acetate of Potassium in *twelve* (12) *fluidounces* of Aromatic Elixir, then add enough of the latter to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains 5 *grains of Acetate of Potassium.*

91. Elixir Potassii Bromidi. *N. F.*

Elixir of Bromide of Potassium.

Bromide of Potassium,	1280 gr.
Citric Acid,	80 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Bromide of Potassium and the Citric Acid in about *twelve* (12) *fluidounces* of Adjuvant Elixir, by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 10 *grains of Bromide of Potassium.*

90. Elixir Potassii Acetatis et Juniperi. *N. F.*

Elixir of Acetate of Potassium and Juniper.

Acetate of Potassium,	640 gr.
Fluid Extract of Juniper,	2 fl. oz.
Carbonate of Magnesium,	120 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Fluid Extract of Juniper with the Carbonate of Magnesium, then add *twelve* (12) *fluidounces* of Aromatic Elixir in which the Acetate of Potassium had previously been dissolved. Filter, and add enough Aromatic Elixir through the filter to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents 5 *grains of Acetate of Potassium and* 7½ *grains of Juniper.*

322. Sal Carolinum Factitium. *N. F.*

Artificial Carlsbad Salt.

I. *In a dry, amorphous form* (Germ. Pharm.).

Sulphate of Potassium,	2 parts.
Chloride of Sodium,	18 parts.
Bicarbonate of Sodium,	36 parts.
Sulphate of Sodium, dried,	44 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

Note.—The dried Sulphate of Sodium is prepared by slowly drying the crystalline salt until it has lost one-half of its weight.

II. *In a crystalline form.*

Sulphate of Potassium,	2 parts.
Chloride of Sodium,	18 parts.
Carbonate of Sodium, in clear crystals,	61 parts.
Sulphate of Sodium, crystallized,	88 parts.
Distilled Water,	50 parts.

Dissolve the Sulphate of Potassium and Chloride of Sodium in the Distilled Water, and add this solution to the other two salts, previously melted in a tared capsule and at a gentle heat in their own water of crystallization. Evaporate the mixture to about *one hundred and eighty* (180) *parts*, set it aside in a cool place, and stir frequently, so as to prevent the formation of large crystals, taking care, however, that none of the salts separate in a pulverulent form. Distribute any remaining water of crystallization uniformly over the crystals, and dry the whole mixture sufficiently by exposure to air, but so that it will retain its crystalline character.

A solution of about 16 *grains of the dry, or about* 27 *grains of the crystalline, salt, in* 6 *fluidounces of water, represents an equal volume of Carlsbad Water* (*Sprudel*) *in its essential constituents.*

Note.—The salts employed in the preparation of the crystalline form must have been purified by recrystallization.

304. Potassii Bromidum Effervescens. N. F.

Effervescent Bromide of Potassium.

Bromide of Potassium,	400 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	260 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) *grains* (*or about a heaped teaspoonful*) *of the above compound represent* 20 *grains of Bromide of Potassium.*

305. Potassii Bromidum Effervescens cum Caffeina. N. F.

Effervescent Bromide of Potassium with Caffeine.

Bromide of Potassium,	200 parts.
Caffeine,	20 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	440 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) *grains* (*or about a heaped teaspoonful*) *of the above compound represent* 10 *grains of Bromide of Potassium and* 1 *grain of Caffeine.*

323. Sal Carolinum Factitium Effervescens. N. F.

Artificial Effervescent Carlsbad Salt.

Artificial Carlsbad Salt, in form of dry powder,	820 parts.
Bicarbonate of Sodium,	630 parts.
Tartaric Acid,	560 parts.
Sugar, in very fine powder,	240 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in the form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

A solution of about 87 *grains of this preparation, in* 6 *fluidounces of water, represents an equal volume of Carlsbad Water* (*Sprudel*) *in its essential constituents.*

Liniment of Iodide of Potassium.

Soap,	420 gr.
Potassium Iodide,	360 gr.
Oil of Lavender,	15 min.
Alcohol,	4 fl. oz.
Water,	6 fl. dr.

Dissolve the Soap in the Alcohol by means of a gentle heat, and filter if it is not perfectly transparent; then add the Oil and the Potassium Iodide dissolved in the Water; mix, and bottle it while warm.

Spleen Mixture.

(Gadberry's.)

Potassium Nitrate,	300 gr.
Quinine Sulphate,	65 gr.
Iron Sulphate,	65 gr.
Nitric Acid,	65 min.
Water,	16 fl. oz.

Mix. Dose, a tablespoonful three times a day.

Liquor Potassii Permanganatis. *U. S.* 1870. SOLUTION OF PERMANGANATE OF POTASSIUM.

Permanganate of Potassium,	64 gr.
Distilled Water,	16 fl. oz.

Dissolve the Permanganate in the Distilled Water.

Benzoated Alkaline Mixture.

(Dr. Ellwood Wilson.)

Potassium Bicarbonate,	90 gr.
Benzoic Acid,	30 gr.
Syrup of Orange,	4 fl. dr.
Water,	2½ fl. oz.

Rub the solids with 4 fl. dr. of Water until effervescence ceases, then add the rest of the Water, filter, and add the Syrup. Dose, a tablespoonful three times a day after meals.

LITHIUM AND SODIUM SALTS.

77. Elixir Lithii Bromidi. N. F.

Elixir of Bromide of Lithium.

Bromide of Lithium.	640 gr.
Citric Acid,	30 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Bromide of Lithium and the Citric Acid in about *twelve* (12) *fluidounces* of Adjuvant Elixir, by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 5 *grains of Bromide of Lithium.*

Neutralizing Powder.

Sodium Bicarbonate,	120 gr.
Powdered Rhubarb,	120 gr.
Oil of Peppermint,	2 min.

Dose, a teaspoonful, as an antacid in diarrhœa and dyspepsia.

78. Elixir Lithii Citratis. *N. F.*

Elixir of Citrate of Lithium.

Citrate of Lithium,	640 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Citrate of Lithium in about *twelve* (12) *fluidounces* of Adjuvant Elixir, by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 5 grains of Citrate of Lithium.

79. Elixir Lithii Salicylatis. *N. F.*

Elixir of Salicylate of Lithium.

Salicylate of Lithium,	640 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Salicylate of Lithium in about *twelve* (12) *fluidounces* of Adjuvant Elixir, by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 5 grains of Salicylate of Lithium.

Anti-Gout Pills.

(Corlieu's.)

Sodium Silicate,	20 gr.
Extract of Colchicum,	12 gr.
Extract of Aconite,	25 gr.
Sodium Benzoate,	40 gr.
Powdered Soap,	40 gr.

Mix, and make into 100 pills.

Soda Mint.

Sodium Bicarbonate,	336 gr.
Spearmint Water,	1 pint.

Dissolve and filter. Dose, a tablespoonful.

Mel Sodii Boratis. *U. S.* 1870. HONEY OF BORATE OF SODIUM.

Borate of Sodium, in fine powder,	60 gr.
Clarified Honey,	1 oz. (troy).

Mix them.

Aromatic and Antacid Corrective of Indigestion.

(Dr. J. J. Levick.)

Sodium Bicarbonate,	80 gr.
Compound Tincture of Cardamom,	4 fl.dr.
Compound Infusion of Gentian,	2½ fl.oz.
Peppermint Water,	3 fl.oz.

Mix. A tablespoonful as required.

Glyceritum Sodii Boratis. *U. S.* 1870.

GLYCERITE OF BORAX.

Sodium Borate,	2 oz. (troy).
Glycerin,	8 fl. oz.

Rub them together in a mortar until the Sodium Borate is dissolved.

Troches of Borax.

Sodium Borate,	150 gr.
Powdered Sugar,	1800 gr.
Carmine, No. 40,	1½ gr.
Tragacanth (in flakes),	5 gr.
Distilled Water,	120 min.
Tincture of Benzoin,	20 min.

Prepare a mucilage from the Tragacanth, with the addition of the Water and Tincture. Dissolve the Carmine in 80 minims of Water of Ammonia. Mix the dry ingredients together, add the Carmine solution and sufficient Tragacanth mucilage to form a mass. Divide the mass into 100 troches, each weighing 20 gr. and containing 1½ gr. of Sodium Borate.

Nipple Wash.

(Dr. Atlee's.)

Sodium Borate,	60 gr.
Acacia,	120 gr.
Tincture of Myrrh,	2 fl. dr.
Rose Water,	2 fl. oz.

Dissolve the Borate in the Rose Water; make a thick mucilage with the Acacia, and emulsify the Tincture of Myrrh; then add the rest of the solution.

Hay-Fever Snuff.

(Dr. Mortimer Granville's.)

Sodium Borate,	20 gr.
Capsicum,	15 gr.
Ammonium Carbonate,	10 gr.

Mix.

234. Liquor Sodii Arseniatis, Pearson. *N. F.*

Pearson's Solution of Arseniate of Sodium.

Arseniate of Sodium, in perfect crystals,	1 part.
Distilled Water, enough to make	600 parts.

Dissolve the Arseniate of Sodium in enough Distilled Water to make *six hundred* (600) *parts*, and filter, if necessary.

Pearson's Solution of Arseniate of Sodium may also be prepared as follows:

Solution of Arseniate of Sodium (U. S. P. 1880),	1 part.
Distilled Water, enough to make	10 parts.

Mix the Solution of Arseniate of Sodium with enough Distilled Water to make *ten* (10) *parts*, and filter, if necessary.

This solution contains about $\frac{1}{10}$ per cent. of anhydrous Arseniate of Sodium.

Note.—This preparation should not be confounded with the *Liquor Sodii Arseniatis* of U. S. P., which is ten times stronger than the above preparation. Pearson's Solution is officinal in the French Pharm., under the title *Soluté d'Arseniate de Soude* (or *Solution Arsenicale de Pearson*). It is recommended that Pearson's Solution be dispensed only when expressly designated as "Pearson's."

Collyrium of Borate of Sodium.

Sodium Borate,	4 gr.
Camphor Water,	1 fl. oz.

Mix.

238. Liquor Sodii Citro-Tartratis. *N.F.*

Solution of Citro-Tartrate of Sodium.

Bicarbonate of Sodium,	390 gr.
Tartaric Acid,	360 gr.
Citric Acid,	30 gr.
Syrup,	1¼ fl. oz.
Water,	10¾ fl. oz.

Dissolve *three hundred and sixty* (360) *grains* of the Bicarbonate of Sodium in the Water and add the Tartaric Acid. When this is dissolved, filter the solution, add the Syrup to the filtrate, then the remainder of the Bicarbonate of Sodium, and, lastly, the Citric Acid, in crystals. Close the bottle at once with a stopper, which should be securely tied.

237. Liquor Sodii Citratis. *N.F.*

Solution of Citrate of Sodium.

Mistura Sodii Citratis. Saturatio. Potio Riveri (*Germ. Pharm.*).

Citric Acid,	150 gr.
Bicarbonate of Sodium,	190 gr.
Water,	16 fl. oz.

Dissolve the Citric Acid in the Water contained in a bottle, add the Bicarbonate of Sodium in divided portions, dissolve it by agitation, and immediately stopper the bottle securely.

This preparation should be freshly prepared when wanted for use.

Note.—The German Pharm. directs that, when "Saturatio" is prescribed, without any specification of the ingredients or strength, *Potio Riveri* represented here by *Liquor Sodii Citratis* be dispensed.

236. Liquor Sodii Carbolatis. *N. F.*

Solution of Carbolate of Sodium.

(Phénol Sodique.)

Carbolic Acid, crystallized,	30 parts.
Soda,	2 parts.
Water,	28 parts.

Dissolve the Soda in the Water, add the Carbolic Acid, and warm gently until it is dissolved.

This preparation should be made freshly when wanted for use.

Note.—The formula is based upon that of the Germ. Pharm. (I., 1872).

235. Liquor Sodii Boratis Compositus. *N. F.*

Compound Solution of Borate of Sodium.

Dobell's Solution.

Borate of Sodium,	120 gr.
Bicarbonate of Sodium,	120 gr.
Carbolic Acid, crystallized,	24 gr.
Glycerin,	½ fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Salts in about *eight* (8) *fluidounces* of Water, then add the Glycerin and the Carbolic Acid previously liquefied by warming, and, lastly, enough Water to make *sixteen* (16) *fluidounces*. Finally, filter.

239. Liquor Sodii Oleatis. *N. F.*

Solution of Oleate of Sodium.

White Castile Soap, dry and powdered,	16 tr. oz.
Water, enough to make	16 pints.

Mix the Castile Soap with *four* (4) *pints* of Water so as to produce a uniform and gelatinous mixture. Then add *ten* (10) *pints* more of Water, apply heat until the Soap is dissolved, allow the liquid to cool, and add enough Water to make it measure *sixteen* (16) *pints*.

Note.—This preparation is intended to be used in the preparation of Oleates.

100. Elixir Sodii Bromidi. *N. F.*

Elixir of Bromide of Sodium.

Bromide of Sodium,	1280 gr.
Citric Acid,	30 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Bromide of Sodium and the Citric Acid in about *twelve* (12) *fluidounces* of Adjuvant Elixir by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm contains 10 *grains of Bromide of Sodium.*

102. Elixir Sodii Salicylatis. *N. F.*

Elixir of Salicylate of Sodium.

Salicylate of Sodium,	640 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Salicylate of Sodium in about *twelve* (12) *fluidounces* of Aromatic Elixir, by agitation. Then add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*, and filter, if necessary.

This preparation should be freshly prepared when required for use.

Each fluidrachm contains 5 *grains of Salicylate of Sodium.*

263. Mistura Sodæ et Menthæ. *N. F.*

Mixture of Soda and Spearmint.

Soda Mint.

Bicarbonate of Sodium,	320 gr.
Aromatic Spirit of Ammonia,	60 min.
Spearmint Water, enough to make	16 fl. oz.

Dissolve the Bicarbonate of Sodium in about *twelve* (12) *fluidounces* of Spearmint Water, add the Aromatic Spirit of Ammonia, and enough Spearmint Water to make *sixteen* (16) *fluidounces*. Filter, if necessary.

325. Sal Kissingense Factitium Effervescens. *N. F.*

Artificial Effervescent Kissingen Salt.

Artificial Kissingen Salt,	540 parts.
Bicarbonate of Sodium,	540 parts.
Tartaric Acid,	480 parts.
Sugar, in very fine powder,	240 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in the form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

A solution of about 80 grains of this preparation, in 6 fluidounces of water, represents an equal volume of Kissingen Water (Rakoczi Spring) in its essential constituents.

324. Sal Kissingense Factitium. *N. F.*

Artificial Kissingen Salt.

Chloride of Potassium,	17 parts.
Chloride of Sodium,	857 parts.
Sulphate of Magnesium, anhydrous,	59 parts.
Bicarbonate of Sodium,	107 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

A solution of about 24 grains of this preparation, in 6 fluidounces of water, represents an equal volume of Kissingen Water (Rakoczi Spring) in its essential constituents.

326. Sal Vichyanum Factitium. *N. F.*

Artificial Vichy Salt.

Bicarbonate of Sodium,	852 parts.
Carbonate of Potassium,	16 parts.
Sulphate of Magnesium, anhydrous,	16 parts.
Chloride of Sodium,	82 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

A solution of about 14 grains of this preparation, in 6 fluidounces of water, repsents an equal volume of Vichy Water (Grande Grille Spring) in its essential constituents.

327. Sal Vichyanum Factitium Effervescens. *N. F.*

Artificial Effervescent Vichy Salt.

Artificial Vichy Salt,	430 parts.
Bicarbonate of Sodium,	570 parts.
Tartaric Acid,	510 parts.
Sugar, in very fine powder,	240 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in the form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

A solution of about 57 grains of this preparation, in 6 fluidounces of water, represents an equal volume of Vichy Water (Grande Grille Spring) in its essential constituents.

328. Sal Vichyanum Factitium Effervescens cum Lithio. *N. F.*

Artificial Effervescent Vichy Salt with Lithium.

Artificial Vichy Salt,	280 parts.
Citrate of Lithium,	100 parts.
Bicarbonate of Sodium,	610 parts.
Tartaric Acid,	540 parts.
Sugar,	270 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in the form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) grains (or about a heaped teaspoonful) of this preparation represent 14 grains of Artificial Vichy Salt and 5 grains of Citrate of Lithium.

383. Syrupus Sodii Hypophosphitis. *N. F.*

Syrup of Hypophosphite of Sodium.

Hypophosphite of Sodium,		256 gr.
Citric Acid,		10 gr.
Sugar,		12 tr. oz.
Water,	enough to make	16 fl. oz.

Dissolve the Hypophosphite of Sodium and the Citric Acid in *eight* (8) *fluidounces* of Water, and filter the solution. In this dissolve the Sugar by agitation, and pass enough Water through the filter to make the product measure *sixteen* (16) *fluidounces.*

Each fluidrachm contains 2 grains of Hypophosphite of Sodium.

330. Soda cum Calce. *N. F.*

Soda with Lime.

London Paste.

Soda,	
Lime, each,	equal parts.

Reduce them to powder in a clean iron mortar, previously warmed, and mix them intimately. Keep the powder in small well-stoppered vials.

331. Sodii Boro-Benzoas. *N. F.*

Boro-Benzoate of Sodium.

Borate of Sodium, in fine powder,	3 parts.
Benzoate of Sodium,	4 parts.

Mix them intimately.

AMMONIUM SALTS.

Carbonate of Ammonium Mixture.

Ammonium Carbonate,	90 gr.
Powdered Acacia,	90 gr.
Sugar,	90 gr.
Aromatic Spirit of Ammonia,	2 fl. dr.
Compound Tincture of Cardamom,	2 fl. dr.
Water,	3½ fl. oz.

Mix. A tablespoonful every two or three hours.

Ammonia Lozenges.

(Dr. Jackson's.)

Ammonium Chloride,	90 gr.
Morphine Hydrochlorate,	3 gr.
Powdered Elm,	360 gr.
Powdered Acacia,	420 gr.
Powdered Sugar,	420 gr.
Powdered Extract of Glycyrrhiza,	420 gr.
Oil of Sassafras,	4 min.
Tincture of Tolu,	3 fl. dr.

To be made with syrup into 180 lozenges, or into lozenges of 10 gr. each, containing ½ gr. of Ammonium Chloride and $\frac{1}{60}$ gr. of Morphine Hydrochlorate.

Asthma Mixture.

(Fothergill's.)

Ammonium Iodide,	120 gr.
Ammonium Bromide,	180 gr.
Syrup of Tolu,	3 fl. oz
Tincture of Lobelia,	5 fl. oz.

Mix. Teaspoonful every one, two, three, or four hours.

Solution of Valerianate of Ammonium.

TASTELESS AND ODORLESS.

(Rother's.)

Ammonium Valerianate,	119 gr.
Sodium Borate (Powdered),	191 gr.
Water of Ammonia, sufficient.	
Distilled Water, sufficient to make	8 fl. oz.

Mix the Ammonium Valerianate with 1 fl. oz. of Distilled Water, and add Water of Ammonia, drop by drop, until a clear and slightly alkaline solution is produced; then add 2 fl. oz. of Distilled Water and the Sodium Borate, and when all has dissolved, except the few contaminating crystals of Calcium Borate, add Distilled Water to make 8 fl. oz., and filter.

7. Aqua Sedativa. *N. F.*

Sedative Water.

Lotio Ammoniacalis Camphorata (*Codex*). Eau Sédative de Raspail.

Water of Ammonia,	2 fl. oz.
Spirit of Camphor,	90 min.
Chloride of Sodium,	1 tr. oz.
Water, enough to make	16 fl. oz.

Dissolve the Chloride of Sodium in about *eight* (8) *fluidounces* of Water, add the Water of Ammonia and Spirit of Camphor, and finally enough Water to make *sixteen* (16) *fluidounces.*

Shake the liquid when it is to be dispensed.

26. Elixir Ammonii Bromidi. *N. F.*

Elixir of Bromide of Ammonium.

Bromide of Ammonium,	640 gr.
Citric Acid,	30 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Bromide of Ammonium and the Citric Acid in about *eight* (8) *fluidounces* of Adjuvant Elixir, by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm contains 5 grains of Bromide of Ammonium.

27. Elixir Ammonii Valerianatis. *N. F.*

Elixir of Valerianate of Ammonium.

Valerianate of Ammonium,	256 gr.
Water of Ammonia, a sufficient quantity.	
Chloroform,	6 min.
Tincture of Vanilla,	120 min.
Compound Tincture of Cudbear,	120 min.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Valerianate of Ammonium in about *twelve* (12) *fluidounces* of Aromatic Elixir, in a graduated vessel, and add enough Water of Ammonia, in drops, until a faint excess of it is perceptible in the liquid. Then add the Chloroform, Tincture of Vanilla, and Compound Tincture of Cudbear, and, finally, enough Aromatic Elixir to make *sixteen* (16) *fluidounces.* Filter, if necessary.

Each fluidrachm contains 2 grains of Valerianate of Ammonium.

Note.—Should the odor of valerianic acid become perceptible after the Elixir has been kept for some time, it may be overcome by slightly supersaturating with Water of Ammonia.

28. Elixir Ammonii Valerianatis et Quininæ. *N. F.*

Elixir of Valerianate of Ammonium and of Quinine.

Hydrochlorate of Quinine,	32 gr.
Elixir of Valerianate of Ammonium,	16 fl. oz.

Dissolve the Hydrochlorate of Quinine in the Elixir by agitation, and, if necessary, by occasionally immersing the bottle containing the ingredients in hot water, until solution has been effected. Finally, filter.

Each fluidrachm contains ¼ grain of Hydrochlorate of Quinine and 2 grains of Valerianate of Ammonium.

195. Linimentum Ammonii Iodidi.
N. F.

Liniment of Iodide of Ammonium.

Iodine,	80 gr.
Oil of Rosemary,	110 min.
Oil of Lavender,	110 min.
Camphor,	220 gr.
Water of Ammonia,	1¼ fl. oz.
Alcohol, enough to make	16 fl. oz.

Dissolve the Iodine, the Oils, and the Camphor in *twelve* (12) *fluidounces* of Alcohol, then add the Water of Ammonia, and, lastly, enough Alcohol to make *sixteen* (16) *fluidounces*.

Note.—On standing, the liquid will become colorless, and there will, usually, be a slight precipitate, which may be separated by filtration.

205. Liquor Ammonii Acetatis Concentratus. *N. F.*

Concentrated Solution of Acetate of Ammonium.

Acetic Acid (U. S. P.),	16 fl. oz.
Carbonate of Ammonium,	a sufficient quantity.
Water, enough to make	32 fl. oz.

Neutralize the Acetic Acid with a sufficient quantity of Carbonate of Ammonium, carefully avoiding an excess. Then add enough Water to make the product measure *thirty-two* (32) *fluidounces*.

Note.—It is not recommended to keep this solution on hand for the preparation of the officinal *Liquor Ammonii Acetatis*, as this is preferably made freshly when wanted for use. When it is, however, required, or deemed of advantage, to dispense the concentrated solution, it is suggested that it be diluted with Carbonic Acid Water, or be directed to be diluted with this at the time of administration.

The product is about four times the strength of the officinal *Liquor Ammonii Acetatis*.

206. Liquor Ammonii Citratis Fortior.
N. F.

Stronger Solution of Citrate of Ammonium.

Citric Acid,	9 tr. oz.
Stronger Water of Ammonia,	
Water, each,	a sufficient quantity.

Neutralize the Citric Acid with the Stronger Water of Ammonia, and add enough Water to make *sixteen* (16) *fluidounces*. The solution should be kept in bottles free from lead.

Each fluidrachm contains about 40 grains of Citrate of Ammonium.

Note.—This Solution is apt to take up notable quantities of lead, if kept in bottles made of flint glass.

Liquor Ammonii Citratis (Brit. Pharm.) may be prepared from this Solution by mixing 1 volume of it with 4 volumes of Water.

249. Mistura Ammonii Chloridi. *N. F.*

Mixture of Chloride of Ammonium.

Mistura (or Mixtura) Solvens Simplex.

Chloride of Ammonium,	180 gr.
Purified Extract of Glycyrrhiza,	180 gr.
Water, enough to make	16 fl. oz.

Dissolve the solids in a sufficient quantity of Water to make *sixteen* (16) *fluidounces*.

Note.—Sometimes a *Mistura* (or *Mixtura*) *Solvens Stibiata* is prescribed. This may be prepared by dissolving 2 grains of Tartrate of Antimony and Potassium in each pint of *Mistura Ammonii Chloridi*.

257. Mistura Expectorans, Stokes.
N. F.

Stokes's Expectorant Mixture.

Stokes's Expectorant.

Carbonate of Ammonium,	128 gr.
Fluid Extract of Senega,	½ fl. oz.
Fluid Extract of Squill,	½ fl. oz.
Camphorated Tincture of Opium,	3 fl. oz.
Water,	1½ fl. oz.
Syrup of Tolu, enough to make	16 fl. oz.

Dissolve the Carbonate of Ammonium in the Water, add the Fluid Extracts and Tincture, and, lastly, enough Syrup of Tolu to make *sixteen* (16) *fluidounces*.

MAGNESIUM SALTS.

Liquor Magnesii Acetatis. Solution of Acetate of Magnesium.

(Neynaber's.)

Calcined Magnesia,	126 gr.
Acetic Acid, sufficient to saturate.	
Syrup of Citric Acid,	2 fl. oz.
Potassium Bicarbonate,	40 gr.
Water, to make	12 fl. oz.

Made and used like Solution of Magnesium Citrate (see page 574).

Magnesia Mixture.

(Dr. Isaac Remington's.)

Magnesia (Husband's),	90 gr.
Blue Mass,	30 gr.
Aromatic Spirit of Ammonia,	2 fl. dr.
Sugar,	60 gr.
Peppermint Water,	2 fl. oz.
Lime-Water,	8 fl. oz.

Mix. A tablespoonful every two hours.

252. Mistura Carminativa. *N. F.*

Carminative Mixture.

Dalby's Carminative.

Carbonate of Magnesium,	1 tr. oz.
Carbonate of Potassium,	20 gr.
Tincture of Opium,	180 min.
Oil of Caraway,	4 drops.
Oil of Fennel,	4 drops.
Oil of Peppermint,	4 drops.
Syrup,	2½ fl. oz.
Water, enough to make	16 fl. oz.

Triturate the Oils with about *sixty* (60) *grains* of Carbonate of Magnesium, and *twelve* (12) *fluidounces* of Water, gradually added. Then add the remainder of the Carbonate of Magnesium and the other ingredients, and, lastly, add enough Water to make *sixteen* (16) *fluidounces*.

This preparation should be freshly made when wanted for use.

Each fluidounce represents about 1 *grain of Opium.*

223. Liquor Magnesii Bromidi. *N. F.*

Solution of Bromide of Magnesium.

Diluted Hydrobromic Acid (U. S. P.),	16 fl. oz.
Carbonate of Magnesium,	a sufficient quantity.

Saturate the Diluted Hydrobromic Acid with a sufficient quantity (about *one* (1) *troyounce*) of Carbonate of Magnesium. When effervescence has ceased, filter.

Each fluidrachm contains about 7 *grains of Bromide of Magnesium.*

CALCIUM SALTS.

39. Elixir Calcii Lactophosphatis. *N. F.*

Elixir of Lactophosphate of Calcium.

Lactate of Calcium,	128 gr.
Phosphoric Acid (U. S. P. 50 per cent.),	128 min.
Water,	1 fl. oz.
Syrup,	1 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Lactate of Calcium with the Phosphoric Acid, the Water, and the Syrup, until the salt is dissolved. Then add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm represents 1 *grain of Lactate of Calcium, or about* 1¼ *grains of so-called Lactophosphate of Calcium.*

Chalk Mixture.

(Richard's.)

Precipitated Calcium Carbonate,	1 oz. (troy).
Sugar,	1 oz. (troy).
Tincture of Opium,	1 fl. dr.
Spirit of Cinnamon,	15 min.
Compound Tincture of Lavender,	1 fl. oz.
Tincture of Kino,	1 fl. oz.
Water,	8 fl. oz.

Mix.

38. Elixir Calcii Hypophosphitis. *N. F.*

Elixir of Hypophosphite of Calcium.

Hypophosphite of Calcium,	256 gr.
Citric Acid,	80 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Hypophosphite of Calcium in *fourteen* (14) *fluidounces* of Aromatic Elixir, and filter. Dissolve the Citric Acid in the filtrate and pass enough Aromatic Elixir through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm contains 2 *grains of Hypophosphite of Calcium.*

Syrup of Hypophosphite of Calcium.

(Procter's.)

Calcium Hypophosphite,	2 oz. (troy).
Sugar,	24 oz. (troy).
Tincture of Vanilla,	1 fl. oz.
Water,	19 fl. oz.

Dissolve the salt in the Water, filter, add the Sugar, dissolve by aid of heat, and add the Tincture. Dose, a teaspoonful to a tablespoonful three times a day.

37. Elixir Calcii Bromidi. *N. F.*

Elixir of Bromide of Calcium.

Bromide of Calcium,	640 gr.
Citric Acid,	80 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Dissolve the Bromide of Calcium and the Citric Acid in about *twelve* (12) *fluidounces* of Adjuvant Elixir by agitation. Then add enough Adjuvant Elixir to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm contains 5 *grains of Bromide of Calcium.*

209. Liquor Calcis Sulphuratæ. *N. F.*

Solution of Sulphurated Lime.

Solution of Oxysulphuret of Calcium. Vleminck's Solution (*or* Lotion).

Lime, freshly slaked,	2 parts.
Sublimed Sulphur,	8 parts.
Water, enough to make	12 parts.

Mix the slaked Lime with the Sulphur, and add the mixture gradually to *twenty* (20) *parts* of boiling Water. Then boil the whole, under constant stirring, until it is reduced to *twelve* (12) *parts*, strain, and, having allowed the solution to become clear by standing in a well-stoppered bottle, decant the clear brown liquid, and keep it in completely-filled and well-stoppered bottles.

385. Talcum Purificatum. *N. F.*

Purified Talcum.

Talcum, in fine powder,	100 parts.
Hydrochloric Acid,	15 parts.
Water,	a sufficient quantity.

Mix *five hundred* (500) *parts* of boiling Water with the Talcum, gradually add *ten* (10) *parts* of the Hydrochloric Acid, and boil the mixture during fifteen minutes. Then allow the suspended Talcum to subside, pour off the supernatant liquid, and boil the residue again with *five hundred* (500) *parts* of Water mixed with the remainder of the Hydrochloric Acid. Again allow the mixture to become clear by settling, pour off the supernatant liquid, and wash the residue with Water, by repeated decantation, until a portion of the wash-water, filtered and placed in

a test-tube, ceases to produce a precipitate with test-solution of nitrate of silver acidified with nitric acid. Then transfer the magma to a close linen or muslin strainer, allow it to drain, and dry it by heat.

Note.—Purified Talcum is used as an aid in filtering turbid liquids containing finely-divided matters in suspension, which are apt to pass through the filter, or to stop up its pores.

321. Pulvis Talci Salicylicus. *N. F.*

Salicylated Powder of Talcum.

Salicylic Acid,	3 parts.
Boric Acid, in fine powder,	10 parts.
Talcum, in fine powder,	87 parts.

Mix them intimately.

Note.—The corresponding preparation of the Germ. Pharm. has the title *Pulvis Salicylicus cum Talco*, and contains 10 parts of Wheat Starch in place of Boric Acid.

354. Syrupus Calcii Chlorhydrophosphatis. *N. F.*

Syrup of Chlorhydrophosphate of Calcium.

Syrup of Chlorhydrophosphate of Lime.

Precipitated Phosphate of Calcium,	128 gr.
Hydrochloric Acid, Water, each,	a sufficient quantity.
Spirit of Lemon,	140 min.
Syrup,	enough to make 16 fl. oz.

Triturate the Precipitated Phosphate of Calcium with *one* (1) *fluidounce* of Water, and dissolve it with the aid of Hydrochloric Acid, avoiding an excess. Then add the Spirit of Lemon, filter the liquid, and wash the filter with a mixture of *one* (1) *fluidounce*, each, of Water and Syrup Lastly, add enough Syrup to the filtrate to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains 1 grain of Phosphate of Calcium.

358. Syrupus Calcii Lactophosphatis cum Ferro. *N. F.*

Syrup of Lactophosphate of Calcium with Iron.

Syrup of Lactophosphate of Lime with Iron.

Lactate of Iron,	64 gr.
Citrate of Potassium,	64 gr.
Water,	1 fl. oz.
Syrup of Lactophosphate of Calcium (U.S.P.),	enough to make 16 fl. oz.

Dissolve the Lactate of Iron and Citrate of Potassium in the Water with the aid of heat, and add enough Syrup of Lactophosphate of Calcium to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains ½ grain of Lactate of Iron and about ½ grain of Lactate of Calcium (or about ⅞ grain of so-called Lactophosphate of Calcium).

Syrup of Phosphate of Calcium.

(Wiegand's.)

Precipitated Calcium Phosphate,	1 oz. (troy).
Hydrochloric Acid,	4 fl. dr.
Sugar,	12 oz. (troy).
Water,	7 fl. oz.

Dissolve the Calcium Phosphate, previously mixed with an ounce of Water, by means of the Acid, and filter; add the Sugar, then the remaining Water, until the bulk is increased to 12 fl. oz., and strain. Dose, a teaspoonful.

Aromatic Chalk Powder.

(Ph. Br.)

Cinnamon,	2 oz. (troy).
Nutmeg, Saffron, of each,	1½ oz. (troy).
Cloves,	360 gr.
Cardamom,	240 gr.
Sugar,	12½ oz. (troy).
Prepared Chalk,	5½ oz. (troy).

Reduce to a powder, and mix thoroughly; then pass through a fine sieve, and finally rub it lightly in a mortar.

312. Pulvis Cretæ Aromaticus. *N. F.*

Aromatic Powder of Chalk.

Cinnamon,	4 parts.
Saffron,	8 parts.
Nutmeg,	8 parts.
Cloves,	1½ parts.
Cardamom,	1 part.
Prepared Chalk,	11 parts.
Sugar,	25 parts.

Mix the ingredients and reduce them to a fine powder. Pass this through a fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle.

Note.—This preparation is equivalent to the *Pulvis Cretæ Aromaticus* of the Brit. Pharm. This authority adds the following note: "If a product of bright color be desired, the saffron may previously be moistened and triturated with a little water or alcohol, or the fresh and faintly damp mixture may be subjected to considerable pressure in the triturating process."

313. Pulvis Cretæ Aromaticus cum Opio. *N. F.*

Aromatic Powder of Chalk with Opium.

Aromatic Powder of Chalk,	39 parts.
Powdered Opium,	1 part.

Mix them intimately.

Every 40 grains of this preparation contain 1 grain of Powdered Opium.

Note.—This preparation is officinal in the Brit. Pharm.

Chalk Ointment.

Prepared Chalk,	120 gr.
Olive Oil,	90 min.
Lard,	270 gr.

Mix.

Chalk Powders.

Prepared Chalk,	180 gr.
Acacia,	60 gr.
Sugar,	60 gr.
Cinnamon (Powdered),	15 gr.

Mix, and divide into 12 powders.

Potter's Powder.

Prepared Chalk,	8 oz. (troy).
Powdered Camphor,	240 gr.
Ammonium Carbonate,	1 oz. (troy).

Mix.

BARIUM SALTS.

Liquor Barii Chloridi. *U. S.* 1870. SOLUTION OF CHLORIDE OF BARIUM.

Chloride of Barium,	1 oz. (troy).
Distilled Water,	3 fl. oz.

Dissolve the Chloride in the Distilled Water, and filter through paper.

ZINC SALTS.

Ceratum Zinci Carbonatis. *U. S.* 1870. CERATE OF CARBONATE OF ZINC.

Precipitated Carbonate of Zinc,	2 oz. (troy).
Ointment,	10 oz. (troy).

Mix them thoroughly.

419. Unguentum Calaminæ. *N. F.*

Calamine Ointment.

Unguentum Zinci Carbonatis (Impuri). Unguentum Calaminare. Turner's Cerate.

Prepared Calamine,	1 part.
Ointment (U. S. P.),	5 parts.

Mix them intimately, by trituration, so as to produce a smooth and homogeneous ointment.

Canquoin's Paste.

Fused Zinc Chloride,	800 gr.
Wheat Flour,	420 gr.
Alcohol,	1 fl. dr.

Rub the Chloride of Zinc to a fine powder, and make a paste with the Alcohol; then add the Wheat Flour, using strong pressure with the pestle. When the paste is homogeneous, spread with a roller into sheets about one-eighth of an inch thick, and, after a few hours' exposure, preserve in well-corked bottles.

Chloride of Zinc Paste.

(Latour's.)

Zinc Chloride,	800 gr.
Zinc Nitrate,	600 gr.
Water,	1 fl. oz.

Dissolve with the aid of heat, and when cool add to each ounce 800 gr. of Wheat Flour. Make a paste, and then roll into sheets one-eighth of an inch thick. Preserve in well-stoppered bottles.

Calamine Lotion.

(Dr. Tilbury Fox's.)

Levigated Calamine,	40 gr.
Zinc Oxide,	20 gr.
Glycerin,	20 min.
Rose Water,	1 fl. oz.

Mix.

Solution of Sulphide of Zinc.

(Dr. Duhring's.)

Zinc Sulphate,	80 gr.
Potassium Sulphide,	80 gr.
Alcohol,	8 fl. dr.
Rose Water,	8½ fl. oz.

Mix. Used for lupus.

Injection for Gonorrhœa.

Zinc Sulphate,	15 gr.
Lead Acetate,	30 gr.
Extract of Opium,	5 gr.
Tannin,	2 gr.
Rose Water,	8 fl. oz.

Mix, and dispense without filtering.

Eye-Water.

(Thomas's.)

Zinc Sulphate,	20 gr.
Sodium Chloride,	20 gr.
Rose Water,	1 fl. oz.

Mix.

109. Elixir Zinci Valerianatis. *N. F.*

Elixir of Valerianate of Zinc.

Valerianate of Zinc,	128 gr.
Stronger Solution of Citrate of Ammonium,	1½ fl. oz.
Alcohol,	2 fl. oz.
Oil of Bitter Almond,	1 drop.
Compound Tincture of Cudbear,	120 min.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Stronger Solution of Citrate of Ammonium with *four* (4) *fluidounces* of Aromatic Elixir and the Alcohol, and triturate the Valerianate of Zinc with this mixture, added gradually and in portions, until solution has been effected. Then add the Oil of Bitter Almond, the Compound Tincture of Cudbear, and, finally, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Allow the mixture to stand a few days, and filter.

Each fluidrachm contains 1 *grain of Valerianate of Zinc.*

273. Oleatum Zinci. *N. F.*

Oleate of Zinc.

Acetate of Zinc, crystallized,	8 tr. oz.
Solution of Oleate of Sodium (N. F.),	8 pints.
Water,	a sufficient quantity.

Dissolve the Acetate of Zinc in *sixteen* (16) *pints* of cold Water, filter the solu-

tion, if necessary, through a pellet of absorbent cotton placed in the neck of a funnel, and then mix it slowly, and under constant stirring, with the Solution of Oleate of Sodium. Transfer the mixture to a wetted muslin strainer, and when the liquid has drained off, wash the precipitate with Water until the washings are practically tasteless. Lastly, dry the precipitate, spread on paper, by exposure to dust-free air, without heat.

The product contains an amount of Zinc corresponding to about 18 *per cent. of Oxide of Zinc.*

Note.—The theoretical yield of Oleate of Zinc obtainable from 8 troyounces of acetate of zinc is 3600 grains; in practice, about 7 troyounces will be obtained. Oleate of Zinc, prepared by the above process, is in the form of a soft, white powder, and may be converted into a plaster or ointment by mixing it with such a proportion of oleic acid as may be required.

241. Liquor Zinci et Ferri Compositus. *N. F.*

Compound Solution of Zinc and Iron.

Deodorant Solution.

Sulphate of Zinc,	16 tr. oz.
Sulphate of Iron,	16 tr. oz.
Naphthol,	20 gr.
Oil of Thyme,	60 min.
Hypophosphorous Acid,	120 min.
Water, enough to make	5 pints.

Dissolve the Sulphate of Zinc and Sulphate of Iron in *five* (5) *pints* of boiling Water, add the Naphthol and Oil of Thyme, and shake the mixture occasionally, in a stoppered bottle, until it is cold. Then add the Hypophosphorous Acid, filter the liquid through a wetted filter, and, lastly, pass enough Water through the latter to make *five* (5) *pints.*

Note.—This solution is used as a simple deodorant and antiseptic for common domestic use, when it is unnecessary or impracticable to employ more powerful agents.

When a deodorant solution is required for purposes where *iron* is objectionable, as, for instance, when woven fabrics are to be steeped in it, the following preparation may be employed:

2. *Liquor Zinci et Aluminii Compositus.*

Sulphate of Zinc,	16 tr. oz.
Sulphate of Aluminium,	16 tr. oz.
Naphthol,	20 gr.
Oil of Thyme,	60 min.
Water, enough to make	5 pints.

Dissolve the Sulphate of Zinc and the Sulphate of Aluminium in *five* (5) *pints* of Water, by the aid of heat, add the Naphthol and Oil of Thyme, and shake the mixture occasionally, in a stoppered bottle, until it cools. Set it aside for a few days, if convenient, and then pass it through a wetted filter, following it with enough Water to make *five* (5) *pints.*

The commercial Sulphate of Aluminium (*not* Alum) may be used for this preparation. This generally contains a trace of iron, but by allowing the liquid to stand, this will be gradually precipitated.

ALUMINUM SALTS.

Diarrhœa Powders.

Powdered Alum,	240 gr.
Powdered Kino,	60 gr.
Powdered Opium,	8 gr.

Mix, and divide into 12 powders. For use in obstinate cases. Dose, one every two or three hours.

204. Liquor Aluminii Acetico-Tartratis. *N. F.*

Solution of Acetico-Tartrate of Aluminium.

Alum (U. S. P.),	150 parts.
Carbonate of Sodium,	140 parts.
Glacial Acetic Acid,	80 parts.
Tartaric Acid,	27 parts.
Water, enough to make	200 parts.

Dissolve the Alum and the Carbonate of Sodium, each, in *two thousand* (2000) *parts* of Water, mix the solutions, and wash the precipitate, first by decantation, and afterwards on a strainer, until the washings run off tasteless. Allow the precipitate to drain and to shrink in volume by exposure on the strainer. Then transfer it to a tared capsule, add the Glacial Acetic and the Tartaric Acids, and apply heat until solution has been effected. Finally, evaporate the liquid to *two hundred* (200) *parts.*

The product contains about 50 *per cent. of dry, so-called Acetico-Tartrate of Aluminium.*

Note.—The dry salt may be obtained by evaporating the solution.

203. Liquor Aluminii Acetatis. *N. F.*

Solution of Acetate of Aluminium.

Sulphate of Aluminium, crystallized,	30 parts.
Acetic Acid (U. S. P.),	80 parts.
Carbonate of Calcium,	13 parts.
Water,	100 parts.

Dissolve the Carbonate of Calcium in the Acetic Acid mixed with *twenty* (20) *parts* of Water, and the Sulphate of Aluminium in *eighty* (80) *parts* of Water. Mix the two solutions, and allow the mixture to stand for twenty-four hours, agitating occasionally. Then pour off the clear solution, and filter.

The Solution contains from 7·5 *to* 8 *per cent. of Basic Acetate of Aluminium.*

Note.—Practically identical with the *Liquor Aluminii Acetici* of the German Pharm.

Nipple Wash.

(Dr. Thomas's.)

Alum,	1 oz. (troy).
Tincture of Galls,	1 fl. oz.

Triturate together, and dispense without straining or filtering.

Gargle of Alum.

Alum,	120 gr.
Honey,	1 fl. oz.
Infusion of Flaxseed,	8 fl. oz.

Make a gargle.

Burrow's Solution.

Lead Acetate,	600 gr.
Alum,	360 gr.
Sodium Sulphate,	60 gr.
Water,	10 fl. oz.

Dissolve the Lead Acetate in 8 fl. oz. of Water, and the Sodium Sulphate and Alum in the remaining Water; mix the solutions and stir; allow it to stand for two days, and filter without washing the residue.

Bromo-Chloralum.

Aluminum Chloride,	1 oz. (troy).
Aluminum Bromide,	240 gr.
Boiling Water,	8 fl. oz.

Dissolve by heat in a water-bath; when cool, filter through paper.

MANGANESE SALTS.

Syrup of Iodide of Manganese.

(Procter's.)

Manganese Sulphate,	1 oz. (troy).
Potassium Iodide,	285 gr.
Sugar,	6 oz. (av).
Water,	
Syrup, of each, sufficient.	

Dissolve the Sulphate and Iodide, each, in 1¼ fl. oz. of cold Water, to which 1 fl. dr. of Syrup has been added. Mix them in a glass-stoppered bottle, and, after the crystals of Potassium Sulphate cease to precipitate, throw the solution on a filter of fine muslin, and allow it to pass into an 8-oz. bottle containing the Sugar; add sufficient Water to the filter to bring up the measure of the resulting Syrup to exactly 8 fl. oz. This contains about 60 gr. of the Iodide to each fl. oz. Dose, 10 minims.

Syrup of Phosphate of Manganese.

(Wiegand's.)

Manganese Sulphate (cryst.),	785 gr.
Sodium Phosphate,	1200 gr.
Hydrochloric Acid,	4 fl. dr.
Sugar,	10 oz. (troy).
Water, sufficient.	

Dissolve the salts separately, each in 8 fl. oz. of Water, and add the solution of Sodium Phosphate to the solution of Manganese Sulphate, as long as it produces a precipitate, which wash with cold Water and dissolve by means of the Acid; dilute till it measures 7 fl. oz., then add the Sugar. Each fl. dr. contains 5 gr. of the salt.

IRON AND CHROMIUM SALTS.

Bitter Tincture of Iron.

(Physick's.)

Iron (filings),	8 oz. (av.).
Ginger (bruised),	
Gentian (bruised), of each,	1 oz. (av.).
Orange Peel,	½ oz. (av.).
Strong Old Cider,	16 fl. oz.

Macerate for two weeks or longer, express, and filter.

Lemonade Iron.

(Goodell's.)

Tincture of Chloride of Iron,	2 fl. dr.
Diluted Phosphoric Acid,	6 fl. dr.
Spirit of Lemon,	2 fl. dr.
Syrup, sufficient to make	6 fl. oz.

Mix. A dessertspoonful in water after meals.

Iron Pills.

Reduced Iron,	100 gr.
Manna,	30 gr.
Glucose, sufficient.	

Make a mass, and divide into 50 pills.

Mixture of Iron and Conium.

(Dr. King's Am. Disp.)

Precipitated Carbonate of Iron,	300 gr.
Inspissated Juice of Conium,	150 min.
Sugar,	1 oz. (av.).
Oil of Cinnamon,	6 min.
Oil of Gaultheria,	6 min.
Tincture of Tolu,	8 fl. oz.
Madeira Wine,	4 fl. oz.
Water,	4 fl. oz.

Mix together, and allow to stand for a week, when it will be ready for use.

Mixture of Gentian and Iron.

(Meigs's.)

Citrate of Iron and Ammonium,	60 gr.
Sugar,	1½ oz. (troy).
Fluid Extract of Gentian,	30 min.
Compound Tincture of Lavender,	1 fl. oz.
Alcohol,	4 fl. dr.
Water, sufficient to make	8 fl. oz.

Mix the fluid extract with 1 fl. oz. of Water and add the Compound Tincture of Lavender; treat this with hydrated oxide of iron, and, having filtered it, mix with the other ingredients, and filter.

59. **Elixir Ferri Hypophosphitis.** *N. F.*

Elixir of Hypophosphite of Iron.

Solution of Hypophosphite of Iron,	768 min.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Solution of Hypophosphite of Iron with enough Aromatic Elixir to

make *sixteen* (16) *fluidounces*. Allow the mixture to stand a few days in a cool place, and filter, if necessary.

Each fluidrachm contains 1 *grain of Hypophosphite of Iron* (*ferric*).

60. Elixir Ferri Lactatis. *N. F.*

Elixir of Lactate of Iron.

Lactate of Iron, in crusts,	128 gr.
Citrate of Potassium,	384 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Lactate of Iron with the Citrate of Potassium and about *four* (4) *fluidounces* of Aromatic Elixir, gradually added, until solution has been effected. Then add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 1 *grain of Lactate of Iron.*

61. Elixir Ferri Phosphatis. *N. F.*

Elixir of Phosphate of Iron.

Phosphate of Iron (U. S. P. 1880),	256 gr.
Water,	1 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Phosphate of Iron in the Water with the aid of heat; then mix this solution with a sufficient quantity of Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains 2 *grains of Phosphate of Iron.*

62. Elixir Ferri Phosphatis, Cinchonidinæ, et Strychninæ. *N. F.*

Elixir of Phosphate of Iron, Cinchonidine, and Strychnine.

Phosphate of Iron (U. S. P. 1880),	256 gr.
Citrate of Potassium,	32 gr.
Sulphate of Cinchonidine,	128 gr.
Sulphate of Strychnine,	1¼ gr.
Alcohol,	1 fl. oz.
Water,	360 min.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Phosphate of Iron and Citrate of Potassium in the Water, using heat, if necessary. To *twelve* (12) *fluidounces* of Aromatic Elixir, contained in a bottle, add the Alcohol, and afterwards the alkaloidal salts, and agitate until the latter are dissolved, or nearly so. Then mix the two solutions, and, having shaken the mixture, add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Finally, filter.

Each fluidrachm contains 2 *grains of Phosphate of Iron*, 1 *grain of Sulphate of Cinchonidine, and* $\frac{1}{100}$ *grain of Sulphate of Strychnine.*

Note.—When this Elixir is mixed with water, it will become cloudy or opaque through the separation of some of its constituents.

63. Elixir Ferri Phosphatis, Quininæ, et Strychninæ. *N. F.*

Elixir of Phosphate of Iron, Quinine, and Strychnine.

Phosphate of Iron (U. S. P. 1880),	256 gr.
Citrate of Potassium,	32 gr.
Hydrochlorate of Quinine,	128 gr.
Sulphate of Strychnine,	1¼ gr.
Alcohol,	1 fl. oz.
Water,	360 min.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Phosphate of Iron and Citrate of Potassium in the Water, using heat, if necessary. To *twelve* (12) *fluidounces* of Aromatic Elixir, contained in a bottle, add the Alcohol, and afterwards the alkaloidal salts, and agitate until the latter are dissolved, or nearly so. Then mix the two solutions, and, having shaken the mixture, add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Finally, filter.

Each fluidrachm contains 2 *grains of Phosphate of Iron*, 1 *grain of Hydrochlorate of Quinine, and* $\frac{1}{100}$ *grain of Sulphate of Strychnine.*

Note.—When this Elixir is mixed with water, it will become cloudy or opaque through the separation of some of its constituents.

64. Elixir Ferri Pyrophosphatis. *N. F.*

Elixir of Pyrophosphate of Iron.

Pyrophosphate of Iron (U. S. P. 1880),	256 gr.
Water,	1 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Pyrophosphate of Iron in the Water, and add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains 2 *grains of Pyrophosphate of Iron.*

65. Elixir Ferri, Quininæ, et Strychninæ. *N. F.*

Elixir of Iron, Quinine, and Strychnine.

Tincture of Citro-Chloride of Iron,	2 fl. oz.
Sulphate of Quinine,	128 gr.
Sulphate of Strychnine,	1¼ gr.
Alcohol,	½ fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the alkaloidal salts in about *twelve* (12) *fluidounces* of Aromatic Elixir, then add the Tincture and the Alcohol, and, finally, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm represents about 1 *grain of Ferric Chloride*, 1 *grain of Sulphate of Quinine, and* $\frac{1}{100}$ *grain of Sulphate of Strychnine.*

178. Ferri et Quininæ Citras Effervescens. *N. F.*

Effervescent Citrate of Iron and Quinine.

Citrate of Iron and Quinine,	20 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	620 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in the form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) *grains* (*or about a heaped teaspoonful*) *of the above compound represent* 1 *grain of Citrate of Iron and Quinine.*

179. Ferri Hypophosphis. *N. F.*

Hypophosphite of Iron.

Ferric Hypophosphite.

Sulphate of Iron and Ammonium (U. S. P.), in perfect crystals,	77 parts.
Hypophosphite of Sodium,	51 parts.
Distilled Water,	a sufficient quantity.

Dissolve the Sulphate of Iron and Ammonium in *three hundred* (300) *parts*, and the Hypophosphite of Sodium in *one hundred* (100) *parts* of Distilled Water, and, if necessary, filter each solution. Then mix them, and stir thoroughly; after a short time transfer the mixture to a close linen or muslin strainer, and wash the precipitate with Distilled Water, until the washings run off tasteless. Transfer the strainer to a warm place and, when the contents are dry, preserve them for use.

Hypophosphite of Iron (*ferric*) may also be prepared in the following manner:

Hypophosphite of Calcium,	1 part.
Solution of Chloride of Iron (U. S. P.),	
Distilled Water, each, a sufficient quantity.	

Dissolve the Hypophosphite of Calcium in *twelve* (12) *parts* of Distilled Water, and filter the solution. To this add Solution of Chloride of Iron, in small portions, stirring well each time and allowing the precipitate to subside before adding a fresh portion. Toward the end, remove a small quantity of the clear supernatant liquid, add to it some Solution of Chloride of Iron diluted with about *ten* (10) *times* its volume of Water, and observe whether any turbidity occurs either at once or after a few minutes. If it remains clear, the precipitation may be regarded as complete. Then transfer the mixture to a close linen or muslin strainer, and wash the precipitate with Distilled Water, until the washings run off tasteless. Transfer the strainer to a warm place and, when the contents are dry, preserve them for use.

Note.—Hypophosphite of Iron is rendered soluble in water by mixing it with about an equal weight of citrate of potassium, or some other alkaline citrate. Theoretically, 100 parts of Sulphate of Iron and Ammonium will yield 51·9 parts, and 100 parts of Hypophosphite of Calcium will yield 85·3 parts of dry Hypophosphite of Iron (ferric).

180. Ferri Phosphas Effervescens. *N. F.*

Effervescent Phosphate of Iron.

Phosphate of Iron (U. S. P. 1880),	40 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	620 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) *grains* (*or about a heaped teaspoonful*) *of the above compound represent* 2 *grains of Phosphate of Iron.*

215. Liquor Ferri Hypophosphitis. *N. F.*

Solution of Hypophosphite of Iron.

Solution of Ferric Hypophosphite.

Sulphate of Iron and Ammonium (U. S. P.), in perfect crystals,	2464 gr.
Hypophosphite of Sodium,	1622 gr.
Citrate of Potassium,	1600 gr.
Glycerin,	2½ fl. oz
Water,	enough to make 16 fl. oz.

Dissolve the Sulphate of Iron and Ammonium, and the Hypophosphite of Sodium, each, in *twenty-four* (24) *fluidounces* of Water, and, if necessary, filter each solution. Then mix them, and stir thoroughly; after a few minutes transfer the resulting magma to a close linen or muslin strainer, and wash the precipitate with about *eight* (8) *fluidounces* of Water. Allow it to drain, and then press it forcibly in the strainer, so as to remove as much of the liquid as possible. Transfer the precipitate from the strainer to a mortar, add to it the Citrate of Potassium, and triturate until a perfectly smooth paste results. Then add the Glycerin, and gradually, while stirring, enough Water to make the solution measure *sixteen* (16) *fluidounces.* Place it for several days in a cold place, if convenient; then pour off the clear solution from any precipitate or crystals that may have formed, and keep

the solution in small, completely-filled, and well-corked bottles.

Solution of Hypophosphite of Iron (ferric) may also be prepared in the following manner:

Hypophosphite of Iron,	1280 gr.
Citrate of Potassium,	1622 gr.
Glycerin,	2½ fl. oz.
Water,	enough to make 16 fl. oz.

Triturate the Hypophosphite of Iron with *six* (6) *fluidounces* of Water to a perfectly smooth mixture, then add the Citrate of Potassium and Glycerin, and apply a gentle heat, until solution has been effected. Allow the liquid to cool, and add enough Water to make *sixteen* (16) *fluidounces*. Place the solution for several days in a cold place, if convenient; then pour off the clear solution from any precipitate or crystals that may have formed, and keep the solution in small, completely-filled, well-corked bottles.

About 6 minims of this Solution represent 1 *grain of Hypophosphite of Iron* (*ferric*).

149. Extractum Ferri Pomatum. *N. F.*

Ferrated Extract of Apples.

Ferri Malis Crudus. Crude Malate of Iron.

Iron, in the form of fine, bright wire, and cut,	1 part.
Ripe Sour Apples,	50 parts.
Water,	a sufficient quantity.

Convert the Sour Apples into a homogeneous pulp by pounding or grinding, and express the liquid portion. Then mix the latter with the Iron in an enamelled or porcelain vessel, macerate for forty-eight hours, and then apply the heat of a water-bath, until no more bubbles of gas are given off, adding a little water from time to time to make up any loss by evaporation. Dilute the liquid with Water to make it weigh *fifty* (50) *parts*, and set it aside for a few days. Then filter, and evaporate the filtrate in the before-mentioned vessel to a thick extract, which should be greenish-black, and should yield a clear solution with water.

Note.—This preparation is inserted here with the title under which it is contained in the German Pharmacopœia. In some others it is called, more correctly, *Extractum Pomi* (or *Pomorum*) *Ferratum*.

216. Liquor Ferri Iodidi. *N. F.*

Solution of Iodide of Iron.

Iron, in the form of fine, bright, and finely-cut wire,	8 tr. oz.
Iodine,	4718 gr.
Hypophosphorous Acid (N.F.),	180 min.
Distilled Water,	enough to make 16 fl. oz.

Mix the Iron with *twelve* (12) *fluidounces* of Distilled Water in a flask, add about one-half of the Iodine, and agitate continuously until the liquid becomes hot. Then moderate the reaction by placing the flask in cold water, or by allowing cold water to flow over it, meanwhile keeping up the agitation. When the reaction has moderated, add one-half of the remaining Iodine at a time, and carefully moderate the reaction each time, in the manner above directed. Finally, raise the contents of the flask to boiling and filter immediately through moistened pure filtering paper (the point of the filter being supported by a pellet of absorbent cotton) into a bottle containing the Hypophosphorous Acid. When all the liquid has passed, rinse the flask with *one-half* (½) *fluidounce* of boiling Distilled Water, and pass this through the filter. Cork the bottle and set it aside to cool. Finally, add enough Distilled Water to make the product measure *sixteen* (16) *fluidounces*.

Each fluidrachm contains about 45 *grains of Iodide of Iron* (*ferrous*).

Note.—On mixing 1 volume of this Solution of Iodide of Iron with 5 volumes of Syrup, the product will contain about 60 grains of Iodide of Iron (ferrous) in each fluidounce, and will be practically identical, measure for measure, but not weight for weight, with the officinal Syrup of Iodide of Iron.

217. Liquor Ferri Oxysulphatis. *N. F.*

Solution of Oxysulphate of Iron.

Sulphate of Iron,	1200 gr.
Nitric Acid,	1200 gr.
Distilled Water,	enough to make 16 fl. oz.

Dissolve the Sulphate of Iron in *fifteen* (15) *fluidounces* of boiling Distilled Water, in a flask, gradually add the Nitric Acid, and continue the heat, until the escaping vapors cease to have a nitrous odor. When the reaction is completed, allow the liquid to cool and add enough Distilled Water to make *sixteen* (16) *fluidounces*.

218. Liquor Ferri Protochloridi. *N.F.*

Solution of Protochloride of Iron.

Solution of Ferrous Chloride.

Iron, in the form of fine, bright, and finely-cut wire,	1130 gr.
Hydrochloric Acid,	10 tr. oz.
Glycerin,	4 fl. oz.
Hypophosphorous Acid (N. F.),	60 min.
Distilled Water,	enough to make 16 fl. oz.

To the Iron, contained in a flask, add *six* (6) *fluidounces* of Distilled Water, and the Hydrochloric Acid, and apply a gentle heat, until effervescence ceases. Then raise the liquid to boiling, keep it at this temperature for a short time so that the Iron may be brought into solution as far as possible, filter the solution through a pellet of absorbent cotton placed in the neck of a funnel, and wash the cotton with a little Distilled Water. Evaporate the

filtrate, over a boiling water-bath, until crystals begin to form, and the escaping vapors cease to redden, or only slightly affect, moistened blue litmus paper. Now add the Glycerin and the Hypophosphorous Acid; continue the heat, if necessary, until a perfect solution is obtained; then transfer the liquid to a graduated bottle, allow it to cool, and add enough Distilled Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about 20 *grains of Protochloride of Iron* (*ferrous chloride*).

264. Mistura Splenetica. *N. F.*

Splenetic Mixture.

Spleen Mixture. Gadberry's Mixture.

Sulphate of Iron,	100 gr.
Sulphate of Quinine,	100 gr.
Nitric Acid,	100 min.
Nitrate of Potassium,	800 gr.
Water, enough to make	16 fl. oz.

Triturate the Sulphate of Iron, reduced to powder, with the Nitric Acid, previously mixed with an equal volume of Water. When effervescence has ceased, warm the mixture gently, until it no longer evolves visible vapors of a yellowish tint. Then add to it the Sulphate of Quinine, the Nitrate of Potassium, and, lastly, enough Water to make *sixteen* (16) *fluidounces*. When solution has been effected, filter.

295. Pilulæ Ferri Carbonatis. *N. F.*

Pills of Carbonate of Iron.

Ferruginous Pills. Blaud's Pills. Chalybeate Pills.

Sulphate of Iron, in clear crystals,	240 gr.
Carbonate of Potassium,	140 gr.
Sugar,	48 gr.
Tragacanth, in fine powder,	16 gr.
Glycerin,	10 min.
Water,	a sufficient quantity.

Triturate the Sulphate of Iron with the Sugar to a uniform powder. In another mortar triturate the Carbonate of Potassium with the Glycerin and *ten* (10) *minims* of Water. Add to this mixture the previously prepared powder, and beat the mass thoroughly until it assumes a greenish color. When the reaction appears to have terminated, incorporate the Tragacanth, and, if necessary, add a little more Water, so as to obtain a mass of a pilular consistence. Divide this into *ninety-six* (96) *pills*.

Each pill represents about 1 *grain of Carbonate of Iron* (*ferrous*).

Note.—Sometimes so-called "3-grain" Blaud's Pills (*Pilulæ Blaudii minores*) are prescribed or demanded. These may be prepared by using the quantities given in the above formula, and dividing the mass into *one hundred and sixty-eight* (168) *pills*.

298. Pilulæ Metallorum. *N. F.*

Metallic Pills.

Pilulæ Metallorum Amaræ. Bitter Metallic Pills.

	Each pill contains:
Reduced Iron,	1 gr.
Sulphate of Quinine,	1 gr.
Strychnine, alkaloid,	$\frac{1}{60}$ gr.
Arsenious Acid,	$\frac{1}{60}$ gr.

Note.—A similar combination is known under the name of *Aitken's Tonic Pills:*

	Each pill contains:
Reduced Iron,	$\frac{2}{3}$ gr.
Sulphate of Quinine,	1 gr.
Strychnine, alkaloid,	$\frac{1}{30}$ gr.
Arsenious Acid,	$\frac{1}{30}$ gr.

362. Syrupus Ferri Arseniatis. *N. F.*

Syrup of Arseniate of Iron.

Arseniate of Sodium (U. S. P.) dried to a constant weight at 100° C. (212° F.),	3 gr.
Citrate of Iron (U. S. P.),	2½ gr.
Water,	½ fl. oz.
Syrup, enough to make	16 fl. oz.

Dissolve the Arseniate of Sodium and Citrate of Iron in the Water, contained in a test-tube, by the aid of heat. Then mix the solution with enough Syrup to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains about $\frac{1}{60}$ *grain of Arseniate of Iron* (*ferric*).

Note.—Care should be taken to select perfectly-formed crystals of Arseniate of Sodium, which must then be dried completely at 100° C. (212° F.), and the 3 grains required for the above formula must be weighed from the *dried* salt. It is advisable to dry a fresh quantity of the salt each time the above Syrup is to be prepared.

363. Syrupus Ferri Citro-Iodidi. *N. F.*

Syrup of Citro-Iodide of Iron.

Tasteless Syrup of Iodide of Iron.

Iodine,	400 gr.
Iron Wire, fine, bright, and finely cut,	200 gr.
Citrate of Potassium,	620 gr.
Sugar,	10 tr. oz.
Distilled Water, enough to make	16 fl. oz.

Mix the Iron with *four* (4) *fluidounces* of Distilled Water in a flask, add *two hundred and sixty-seven* (267) *grains* of the Iodine, and apply a gentle heat until the Iodine is combined and the solution has acquired a greenish color. Then heat the contents of the flask to boiling, filter the liquid, and wash the filter with *one-half* (½) *fluidounce* of hot Distilled Water. To the hot filtrate add the Citrate of Potassium, and afterwards the remainder of the Iodine, and agitate until the liquid has assumed a greenish color. Pour this upon the Sugar contained in a bottle, agitate until solution has been effected, and when

the liquid is cold, add enough Distilled Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains an amount of Iron corresponding to about 8·6 grains of Ferric Iodide.

Note.—The officinal *Syrupus Ferri Iodidi* contains about 8 grains of *ferrous iodide* (protiodide of iron) in each fluidrachm. The above preparation contains the iron in the *ferric* condition.

364. Syrupus Ferri et Mangani Iodidi. *N. F.*

Syrup of Iodide of Iron and Manganese.

Iodine,	595 gr.
Iron Wire, fine, bright, and finely cut,	192 gr.
Sulphate of Manganese,	192 gr.
Iodide of Potassium,	230 gr.
Sugar,	12 tr. oz.
Distilled Water, enough to make	16 fl. oz.

Mix the Iron with *four* (4) *fluidounces* of Distilled Water in a flask, add the Iodine, and prepare a solution of ferrous iodide, in the usual manner, aiding the process, if necessary, by heating the contents of the flask, at first gently, and, finally, to boiling. Filter the liquid, through a small filter, directly upon the Sugar, contained in a suitable bottle. Dissolve the Sulphate of Manganese in *two* (2) *fluidounces* of Distilled Water, and the Iodide of Potassium in *two* (2) *fluidounces* of Diluted Alcohol, mix the two solutions and filter into the same bottle which contains the Sugar and the Iron solution. Wash the filter with *one-half* (½) *fluidounce* of cold Distilled Water, receiving the washings in the same bottle. Agitate until the Sugar is dissolved, and, if necessary, strain. Finally, make up the volume with Distilled Water to *sixteen* (16) *fluidounces*.

Each fluidrachm contains about 6 grains of Iodide of Iron (ferrous) and 3 grains of Iodide of Manganese.

366. Syrupus Ferri Lactophosphatis. *N. F.*

Syrup of Lactophosphate of Iron.

Lactate of Iron,	128 gr.
Phosphoric Acid (50 per cent.),	a sufficient quantity.
Water,	½ fl. oz.
Syrup, enough to make	16 fl. oz.

Dissolve the Lactate of Iron in the Water with the aid of a sufficient quantity of Phosphoric Acid, avoiding an excess, and add enough Syrup to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains 1 grain of Lactate of Iron, or about 1½ grains of so-called Lactophosphate of Iron.

367. Syrupus Ferri Protochloridi. *N. F.*

Syrup of Protochloride of Iron.

Syrup of Ferrous Chloride.

Solution of Protochloride of Iron,	384 min.
Glycerin,	2 fl. oz.
Orange-Flower Water,	2 fl. oz.
Syrup, enough to make	16 fl. oz.

Mix the Solution of Protochloride of Iron with the Glycerin and Orange-Flower Water, and add enough Syrup to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains about 1 grain of Protochloride of Iron (ferrous chloride).

Note.—This Syrup requires care in its preservation, notwithstanding the pains taken in preparing the Solution of Protochloride of Iron to protect it from oxidation.

It should be kept in small, well-stoppered bottles.

368. Syrupus Ferri Saccharati Solubilis. *N. F.*

Syrup of Soluble Saccharated Iron.

Syrupus Ferri Oxydati Solubilis (*Germ. Pharm.*). Syrup of Saccharated Oxide of Iron. Syrup of Soluble Oxide of Iron.

1. Solution of Chloride of Iron (U. S. P.),	8 parts.
Soda,	
Distilled Water, each,	a sufficient quantity.
Sugar,	80 parts.
Syrup, enough to make	100 parts.

Prepare a sufficient quantity of a solution of Soda, of the specific gravity 1·160; gradually add, under stirring, *twenty-three* (23) *parts* of this to the Solution of Chloride of Iron, previously mixed with *seven* (7) *parts* of Syrup, and set the mixture aside, during twenty-four hours, in a dark place. Then pour the clear liquid slowly into *one hundred and sixty* (160) *parts* of boiling Distilled Water, continue the boiling for a few minutes, and then set the mixture aside during one day, in a dark place, so that it may become clear by settling. Withdraw the supernatant liquid by means of a siphon, then wash the residue again with *one hundred and sixty* (160) *parts* of boiling Distilled Water, by decantation. Transfer the magma to a wetted strainer, and wash it with hot Distilled Water until this runs off colorless, but so that the mass on the strainer still retains a moderately strong alkaline reaction. Then allow the excess of liquid to drain off, transfer the moist magma to a tared porcelain capsule, add the Sugar, and heat it on a water-bath, with exclusion of daylight, during two hours, replacing from time to time any Water lost by evaporation, and cautiously adding small portions of the Soda solution, until the magma is entirely dissolved. Lastly, add enough Syrup to

make the product weigh *one hundred* (100) *parts*, and transfer the product to bottles, which should be completely filled and stored in a cool and dark place.

One hundred grains, or about 75 minims, of this Syrup represents approximately 1 *grain of metallic Iron.*

Note.—The above process is based upon that of the Germ. Pharm. (1st edition). The formula given by the second edition of this work presupposes the keeping in stock of a dry "Ferrum Oxydatum Saccharatum Solubile" (Saccharated Oxide of Iron), representing 3 per cent. of metallic Iron. When this is available, the *Syrup of Soluble Saccharated Iron* may also be prepared by the following formula:

Syrupus Ferri Saccharati Solubilis.

Syrup of Soluble Saccharated Iron.

(Second Formula.)

Saccharated Oxide of Iron,
Syrup,
Water, each, equal parts.

Dissolve the Saccharated Oxide of Iron in the mixed liquids.

395. Syrupus Ferri Hypophosphitis. *N. F.*

Syrup of Hypophosphite of Iron.

Hypophosphite of Iron,	128 gr.
Citrate of Potassium,	160 gr.
Orange-Flower Water,	1 fl. oz
Syrup, enough to make	16 fl. oz

Dissolve the Hypophosphite of Iron, with the aid of the Citrate of Potassium, in the Orange-Flower Water, and add enough Syrup to make *sixteen* (16) *fluidounces.*

Each fluidrachm contains 1 *grain of Hypophosphite of Iron (ferric).*

396. Tinctura Ferri Chloridi Ætherea. *N. F.*

Ethereal Tincture of Chloride of Iron.

Bestucheff's Tincture. Lamotte's Drops.

Solution of Chloride of Iron (U. S. P.),	850 min.
Stronger Ether,	4 fl. oz.
Alcohol, enough to make	16 fl. oz.

Mix the Solution of Chloride of Iron with *ten* (10) *fluidounces* of Alcohol, add the Stronger Ether, and, lastly, enough Alcohol to make *sixteen* (16) *fluidounces.* Introduce the Tincture into bottles made of white (flint) glass, which should not be entirely filled. Cork them tightly and expose them to the rays of the sun until the Tincture has been completely decolorized. Then remove the bottles to a shady place, and open them occasionally, until the contents have again assumed a yellow color. Lastly, transfer the Tincture to bottles, which should be well stoppered and kept in a cool and dark place.

Each fluidrachm represents about ½ grain of metallic Iron.

Note.—This preparation is practically identical with that which is officinal in the Germ. Pharm.

397. Tinctura Ferri Citro-Chloridi. *N. F.*

Tincture of Citro-Chloride of Iron.

Tasteless Tincture of Chloride of Iron. Tasteless Tincture of Iron.

Solution of Chloride of Iron (U. S. P.),	4 fl. oz.
Citrate of Sodium,	7 tr. oz.
Alcohol,	2½ fl. oz.
Water, enough to make	16 fl. oz.

Mix the Solution of Chloride of Iron with *four* (4) *fluidounces* of Water, and dissolve in this mixture the Citrate of Sodium with the aid of a gentle heat. Then add the Alcohol, and when the solution has become cold, make up the volume with water to *sixteen* (16) *fluidounces.* Set the product aside in a cold place for a few days, if convenient, so that the excess of saline matter may separate. Then filter, and pass enough cold Water through the filter to restore the original volume.

Each fluidrachm contains an amount of Iron equivalent to about 7½ grains of dry Chloride of Iron (ferric).

Note.—This preparation is practically identical in the strength of iron, but not in the quantity of alcohol, with the officinal *Tinctura Ferri Chloridi.*

398. Tinctura Ferri Pomata. *N. F.*

Tincture of Ferrated Extract of Apples.

Tinctura Ferri Malatis Crudi. Tincture of Crude Malate of Iron.

Ferrated Extract of Apples,	800 gr.
Alcohol,	1½ fl. oz.
Cinnamon Water, enough to make	16 fl. oz.

Dissolve the Ferrated Extract of Apples in *twelve* (12) *fluidounces* of Cinnamon Water, add the Alcohol, filter, and pass enough Cinnamon Water through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents about ⅜ grain of metallic Iron.

Note.—This preparation is practically identical with that officinal in the Germ. Pharm. Ferrated Extract of Apples is the *Extractum Ferri Pomatum.* See No. 149.

Grissolle's Pills.

Alcoholic Extract of Nux Vomica,	4 gr.
Iron Phosphate,	46 gr.
Extract of Quassia,	81 gr.
Extract of Gentian, sufficient.	

Mix, and make into 25 pills. One pill three times a day, in conjunction with cold hip-baths, and abstention from drink during the evening. Used for incontinence of urine.

Compound Iron Pills.

(Thomson's.)

Iron Subcarbonate,	60 gr.
Extract of Conium,	60 gr.

Mix, and divide into 24 pills.

Mixture of Iron and Conium.

(Tully's.)

Iron Subcarbonate,	600 gr.
Extract of Conium,	300 gr.
Sugar,	8 oz. (troy).
Oil of Cassia,	18 min.
Oil of Gaultheria,	20 min.
Compound Tincture of Cinnamon,	2 fl. oz.
Tincture of Tolu,	4 fl. dr.
Water, sufficient to make	16 fl. oz.

Mix thoroughly.

Startin's Mixture.

Iron Sulphate,	60 gr.
Magnesium Sulphate,	1 oz. (troy).
Tincture of Gentian,	1 fl. oz.
Diluted Sulphuric Acid,	4 fl. dr.
Water,	8 fl. oz.

A teaspoonful to be taken after eating.

Tonic Laxative.

(Dr. C. H. Thomas.)

Powdered Aloes,	24 gr.
Dried Iron Sulphate,	24 gr.
Alcoholic Extract of Hyoscyamus,	6 gr.
Extract of Nux Vomica,	6 gr.
Oleoresin of Capsicum,	4 gr.

Make into a mass, and divide into 24 pills.

Emmenagogue Pills.

(Dr. Otto's.)

Dried Iron Sulphate,	48 gr.
Powdered Aloes,	12 gr.
Turpentine,	32 gr.
Oil of Turpentine,	10 min.

Make a mass, and divide into 30 pills. Dose, two, three times a day.

213. Liquor Electropoeicus. *N. F.*

Battery Fluid.

A. For the Carbon and Zinc Battery.

I. For ordinary use.

Bichromate of Sodium, in coarse powder,	6 tr. oz.
Sulphuric Acid, commercial,	6 fl. oz.
Water, cold,	48 fl. oz.

Pour the Sulphuric Acid upon the powdered Bichromate, and stir the mixture occasionally during one hour. Then slowly add the Water.

II. For use with the Galvano-Cautery.

Bichromate of Sodium, in coarse powder,	6¼ tr. oz.
Sulphuric Acid, commercial,	14 fl. oz.
Water, cold,	48 fl. oz.

Proceed in the same manner as directed under No. 1.

Note.—Bichromate of Sodium is more soluble than the potassium salt, and its products of decomposition, in the battery, are also more soluble. As it is also much cheaper, it is now preferred in all large electric laboratories. When it cannot be obtained, Bichromate of Potassium may be used in place of it, as heretofore. The two salts may be substituted for each other, weight for weight.

B. For the Leclanché Battery.

Chloride of Ammonium,	6 tr. oz.
Water, enough to make	20 fl. oz.

Dissolve the salt in the Water.

NICKEL SALTS.

Syrup of Bromide of Nickel.

(Dr. Da Costa's.)

Nickel Bromide,	160 gr.
Glycerin,	4 fl. dr.
Sugar,	8 oz. (av.).
Water,	4 fl. oz.

Dissolve the Nickel Bromide in the Water, and add the Glycerin. Make a syrup by cold percolation or agitation.

Pills of Bromide of Nickel.

(Dr. Da Costa's.)

Nickel Bromide,	60 gr.
Powdered Althæa,	6 gr.
Extract of Gentian,	6 gr.
Alcohol, sufficient.	

Mix, and make into 12 pills.

LEAD SALTS.

Pills of Acetate of Lead.

(University College, London.)

Lead Acetate,	12 gr.
Morphine Hydrochlorate,	6 gr.
Extract of Hyoscyamus,	48 gr.

Make a mass, and divide into 24 pills.

Compound Cerate of Lead.

(J. Parrish, Sr.)

Cerate of Subacetate of Lead,	240 gr.
Cerate,	240 gr.
Powdered Opium,	60 gr.
Mild Chloride of Mercury,	60 gr.

Mix. Used in eruptions of a local character.

111. Emplastrum Fuscum Camphoratum. *N. F.*

Camphorated Brown Plaster.

Emplastrum Matris Camphoratum; Camphorated Mother's Plaster.

Red Oxide of Lead,	30 parts.
Olive Oil,	60 parts.
Yellow Wax,	15 parts.
Camphor,	1 part.

Triturate the Red Oxide of Lead with a portion of the Oil in a capacious copper kettle until a smooth paste results. Then add the remainder of the Oil, excepting a small quantity required for trituration with the Camphor, and boil the whole over a naked fire, under constant stirring, until gas bubbles rise, or until the red color of the mixture begins to turn brown. Then moderate the heat, but keep up the stirring until the mixture has acquired a dark-brown color, and from time to time allow some drops of it to fall into cold water to test its consistence. When this is satisfactory, remove the vessel from

the fire, add the Wax in small pieces, and finally the Camphor, previously rubbed to a smooth paste with a little Olive Oil. Mix thoroughly, allow the mixture to become somewhat cool, and while it is still warm, pour the plaster into paper moulds previously coated with mucilage containing about five per cent. of glycerin, and dried.

Note.—This preparation is officinal in the *German Pharmacopœia.*

Judkin's Ointment.

Lead Acetate,	360 gr.
Lead Oxide (Red),	1 oz. (troy).
Sodium Borate,	60 gr.
Oil of Turpentine,	15 min.
Olive Oil,	2 fl. dr.
Linseed Oil,	4 fl. oz.

Boil the first two oils together for four hours, remove from the fire, add, with stirring, the Lead Oxide, Sodium Borate, and Lead Acetate; when nearly cool, add the Turpentine.

246. Lotio Plumbi et Opii. *N. F.*

Lotion of Lead and Opium.

Lead and Opium Wash.

Acetate of Lead,	120 gr.
Tincture of Opium,	½ fl. oz.
Water,	enough to make 16 fl. oz.

Dissolve the Acetate of Lead in about *ten* (10) *fluidounces* of Water, add the Tincture of Opium, and enough Water to make *sixteen* (16) *fluidounces.*

This mixture should be well agitated whenever any of it is to be dispensed.

Glycerole of Subacetate of Lead.

(Dr. Balmanno Squire.)

Lead Acetate,	1 oz. (troy).
Lead Oxide,	336 gr.
Glycerin,	4 fl. oz.

Mix, and expose for some time to a temperature of 176.6° C. (350° F.). Filter through paper in a hot-water funnel.

Diarrhœa Pills.

(Prof. William Thompson's.)

Lead Acetate,	16 gr.
Powdered Camphor,	12 gr.
Powdered Opium,	8 gr.
Bismuth Subcarbonate,	12 gr.
Extract of Gentian, sufficient.	

Mix, and make into 12 pills.

248. Mistura Adstringens et Escharotica. *N. F.*

Astringent and Escharotic Mixture.

Villate's Solution.

Solution of Subacetate of Lead,	1½ fl. oz.
Sulphate of Copper,	1 tr. oz.
Sulphate of Zinc,	1 tr. oz.
Diluted Acetic Acid (U.S.P.),	13 fl. oz

Dissolve the Sulphate of Copper and Sulphate of Zinc in the Diluted Acetic Acid, add the Solution of Subacetate of Lead, and agitate thoroughly. Set the mixture aside, so that the precipitate may subside. Then decant, or siphon off, the clear liquid and preserve it for use.

Note.—In attempting to pass the liquid through a filter, it will usually be found that the finely-divided precipitate of sulphate of lead will partially pass along with it. This may be prevented (in this and many similar cases) by adding to the mixture a small quantity of starch, thoroughly incorporating this by agitation, and pouring the mixture on the previously wetted filter. The first portions of the filtrate are poured back until it runs through clear.

271. Oleatum Plumbi. *N. F.*

Oleate of Lead.

Acetate of Lead,	8 tr. oz.
Solution of Oleate of Sodium (N. F.),	5 pints.
Acetic Acid,	
Water,	each, a sufficient quantity.

Dissolve the Acetate of Lead in *ten* (10) *pints* of Water. Should the solution be turbid or opalescent, add to it Acetic Acid, in drops, until it has become clear. Then filter it, if necessary, through a pellet of absorbent cotton placed in the neck of a funnel, and mix it slowly, and under constant stirring, with the Solution of Oleate of Sodium. Heat the mixture to boiling, transfer it to a strainer, and when the liquid has drained off, wash the residue with *ten* (10) *pints* of boiling Water. Lastly, take the mass from the strainer, remove any occluded Water by pressure, and transfer it, while warm and soft, to suitable vessels.

The product contains an amount of Lead corresponding to about 28 *per cent. of Oxide of Lead.*

Note.—The theoretical yield of Oleate of Lead obtainable from 8 troyounces of acetate of lead is 2839 grains; in practice, about 5 troyounces will be obtained. Oleate of Lead prepared by the above process is of about the consistence of lead-plaster, and may be converted into an ointment by mixing with it such a proportion of oleic acid as may be required.

Logan's Plaster.

Lead Oxide,	2 oz. (av.).
Lead Carbonate,	2 oz. (av.).
Soap,	1½ oz. (av.).
Fresh Butter,	240 gr.
Olive Oil,	5 fl. oz.
Powdered Mastic,	20 gr.

Mix the Soap, Oil, and Butter together, then add the Lead Oxide, and boil it gently over a slow fire for an hour and a half, or until it has a pale brown color, stirring constantly; the heat may then be increased, and the boiling continued, till a portion of the melted plaster, being dropped on a smooth board, is found not to adhere; then remove it from the fire, and add the mastic.

Mother's Salve.

(EMPLASTRUM FUSCUM. ONGUENT DE LA MÈRE.)

Lead Oxide,	60 gr.
Burgundy Pitch,	12 gr.
Yellow Wax,	60 gr.
Mutton Tallow,	60 gr.
Lard,	60 gr.
Olive Oil,	120 gr.
Butter,	60 gr.

Place the fatty substances in a suitable vessel, and heat them until they begin to smoke; then add the Lead Oxide in small portions, constantly stirring the mass with a wooden spatula. Keep the mixture over the fire, constantly agitating, until it acquires a brown color, then mix in the Pitch and pour into moulds.

COPPER SALTS.

Cauterizing Pencils of Sulphate of Copper.

Copper Sulphate,	240 gr.
Sodium Borate,	60 gr.

Triturate together in a warm mortar; the mass becomes soft from the liberation of water of crystallization and it may be readily rolled into sticks. If it becomes too dry, a little water may be added.

Metz's Balsam.

Powdered Aloes,	120 gr.
Verdigris,	180 gr.
Zinc Sulphate,	90 gr.
Turpentine,	2 oz. (troy).
Oil of Juniper,	4 fl. oz.
Oil of Cloves,	1 fl. dr.
Oil of Laurel Berries,	1 fl. oz.
Olive Oil,	4½ fl. oz.
Linseed Oil,	4½ fl. oz.

Melt the Turpentine, Olive Oil, Linseed Oil, and Oil of Laurel Berries by a gentle heat, and add the Aloes, Verdigris, and Zinc Sulphate. Pour into a bottle, and add the Oil of Juniper and Cloves, shaking well. Used as a dressing for ulcers, etc.

212. Liquor Cupri Alkalinus. *N. F.*

Alkaline Solution of Copper.

Fehling's Solution.

I. The Copper Solution.

Sulphate of Copper, pure,	34·639 Gm.	505 gr.
Distilled Water, enough to make	500 C.c.	16 fl. oz.

Dissolve the Sulphate of Copper, which before being weighed should have been reduced to powder and pressed between blotting-paper, in a sufficient quantity of Distilled Water to produce the volume required by the corresponding formula above given.

II. The Alkaline Solution.

Tartrate of Potassium and Sodium,	173 Gm.	2520 gr.
Soda (U. S. P. 1880),	60 Gm.	2 tr. oz.
Distilled Water, enough to make	500 C.c.	16 fl. oz.

Dissolve the Tartrate of Potassium and Sodium and the Soda in a sufficient quantity of Distilled Water to produce the volume required by the corresponding formula above given. Set the mixture aside until the suspended impurities have been deposited; then remove the clear solution with a siphon.

Keep both solutions, separately, in small well-stoppered vials, in a cool and dark place. For use, mix exactly equal volumes of both solutions, by pouring the copper solution into the alkaline solution.

Note.—The two Solutions should be prepared with cold distilled water, and should be made up to their respective volumes at one and the same temperature. They should also be at the same temperatures at the time of mixing. On diluting a small quantity of the mixed Reagent with about three volumes of Distilled Water, and heating the liquid in a test-tube to boiling, it should remain entirely clear, without any trace of discoloration or precipitate.

After the Solutions have been mixed for use, and assuming that they have been prepared and mixed at the average in-door temperature, 10 C.c. of the mixture prepared by metric weight and measure correspond to 0·05 Gm. of glucose. Of the mixture prepared by apothecaries' weight and measure, 210 minims correspond to 1 grain of glucose.

SILVER SALTS.

Pills of Nitrate of Silver.

Nitrate of Silver,	20 gr.
Powdered French Chalk,	80 gr.
Petrolatum, q. s.	

Make a mass, and divide into 40 pills.

MERCURY SALTS.

Mercurial Plaster.

(De Vigo's.)

Lead Plaster,	2000 gr.
Yellow Wax,	100 gr.
Resin,	100 gr.
Powdered Olibanum,	30 gr.
Ammoniac,	30 gr.
Powdered Bdellium,	30 gr.
Powdered Myrrh,	30 gr.
Powdered Saffron,	20 gr.
Mercury,	600 gr.
Turpentine,	100 gr.
Storax,	300 gr.
Oil of Lavender,	10 gr.

Mix.

Scott's Ointment.

Strong Mercurial Ointment,	1 oz. (troy).
Soap Cerate,	1 oz. (troy).
Powdered Camphor,	60 gr.

Mix.

Compound Ointment of Mercury.

Mercurial Ointment,	120 gr.
Ointment of Belladonna,	120 gr.
Iodine Ointment,	120 gr.

Mix.

Van Swieten's Solution.

(Solution Antisyphilitique de Van Swieten. Liqueur d'Oxymuriate de Mercure.)

Corrosive Chloride of Mercury,	15 gr.
Alcohol (80 per cent.),	8½ fl. oz.
Distilled Water, sufficient to make	32 fl. oz.

A tablespoonful contains nearly ⅛ grain of Corrosive Chloride of Mercury.

314. Pulvis Hydrargyri Chloridi Mitis et Jalapæ. *N. F.*

Powder of Mild Chloride of Mercury and Jalap.

Calomel and Jalap.

Mild Chloride of Mercury,	10 gr.
Jalap, in fine powder,	20 gr.

Mix them intimately.

Note.—When "Calomel and Jalap" is prescribed for an adult, without any specification of quantities, it is recommended that the above mixture be dispensed as one dose.

219. Liquor Hydrargyri et Potassii Iodidi. *N. F.*

Solution of Iodide of Mercury and Potassium.

Solution of Iodohydrargyrate of Potassium. Channing's Solution.

Red Iodide of Mercury,	72 gr.
Iodide of Potassium,	56 gr.
Distilled Water, enough to make	16 fl. oz.

Dissolve the salts in the Distilled Water.

244. Lotio Flava. *N. F.*

Yellow Lotion.

Yellow Wash. Lotio Hydrargyri Flava (*Brit. Pharm.*). Aqua Phagedænica Flava (*Germ. Pharm.*).

Corrosive Chloride of Mercury,	24 gr.
Water,	a sufficient quantity.
Solution of Lime, enough to make	16 fl. oz.

Dissolve the Corrosive Chloride of Mercury in *one-half* (½) *fluidounce* of boiling Water, and add the solution to a sufficient quantity of Solution of Lime to make *sixteen* (16) *fluidounces*.

This mixture should be well agitated whenever any of it is to be dispensed.

245. Lotio Nigra. *N. F.*

Black Lotion.

Black Wash. Lotio Hydrargyri Nigra (*Brit. Pharm.*). Aqua Phagedænica Nigra (*Germ. Pharm.*).

Mild Chloride of Mercury,	64 gr.
Water,	a sufficient quantity.
Solution of Lime, enough to make	16 fl. oz.

Triturate the Mild Chloride of Mercury with *one-half* (½) *fluidounce* of Water, and gradually add a sufficient quantity of Solution of Lime to make *sixteen* (16) *fluidounces*.

This mixture should be well agitated whenever any of it is to be dispensed.

389. Tinctura Antacrida. *N. F.*

Antacrid Tincture.

Dysmenorrhœa Mixture. Fenner's Guaiac Mixture.

Corrosive Chloride of Mercury,	40 gr.
Resin of Guaiac, in fine powder,	2 tr. oz.
Canada Turpentine,	2 tr. oz.
Oil of Sassafras,	½ fl. oz.
Alcohol, enough to make	16 fl. oz.

Introduce the Resin of Guaiac and the Canada Turpentine into a flask, together with *twelve* (12) *fluidounces* of Alcohol, cork the flask loosely, and heat the contents, on a water-bath, slowly to boiling. Then cool the flask, and filter the contents through a small filter. Dissolve the Corrosive Chloride of Mercury in *one-half* (½) *fluidounce* of Alcohol, and add this solution, as well as the Oil of Sassafras, to the filtrate. Lastly, pass enough Alcohol through the filter to make the product measure *sixteen* (16) *fluidounces*.

Each fluidrachm contains nearly ⅙ grain of Corrosive Chloride of Mercury.

Note.—The dose of this preparation is about 10 to 20 minims.

Liniment of Mercury.

Liniment of Camphor,	1 fl. oz.
Tincture of Quillaia,	8 fl. oz.
Stronger Water of Ammonia,	160 min.
Water,	140 min.
Mercurial Ointment,	1 oz. (troy).

Mix.

Corrosive Sublimate Gauze.

Corrosive Chloride of Mercury,	2 gr.
Glycerin,	50 min.
Water,	1 fl. oz.

Immerse bleached absorbent muslin in this solution for about twelve hours; then wring it out, and allow it to dry as far as the Glycerin will permit.

Palmer's Lotion.

Corrosive Chloride of Mercury,	4 gr.
Alum,	6 gr.
Water,	8 fl. oz.

Dissolve. For external use.

Townsend's Mixture.

(N. Y. Hosp.)

Red Iodide of Mercury,	1 gr.
Potassium Iodide,	300 gr.
Syrup of Orange Peel,	2 fl. oz.
Compound Tincture of Cardamom,	2 fl. dr.
Water, sufficient to make	4 fl. oz.

Mix. Dose, 1 to 4 teaspoonfuls.

Tetter Ointment.

(Dr. S. G. Morton.)

Alum,	120 gr.
Lead Carbonate,	120 gr.
Calomel,	120 gr.
Oil of Turpentine,	2 fl. dr.
Ointment,	1½ oz. (troy).

Triturate the powders together till they are impalpable and thoroughly mixed; then incorporate them with the Oil and Ointment.

Syrup of Iodohydrargyrate of Iron.

Red Iodide of Mercury,	1 gr.
Syrup of Iodide of Iron,	4 fl. oz.

Mix. Dose, 20 to 30 minims, as an alterative tonic.

Unguentum Hydrargyri Iodidi Rubri. *U. S.* 1870. OINTMENT OF RED IODIDE OF MERCURY.

Red Iodide of Mercury, in fine powder,	16 gr.
Simple Ointment,	1 oz. (av.).

Mix thoroughly.

Syrup of Iodohydrargyrate of Potassium. (SIROP GIBERT.)

Red Iodide of Mercury,	5 gr.
Potassium Iodide,	260 gr.
Distilled Water,	6 fl. dr.
Syrup, sufficient to make	16 fl. oz.

Dose, 1 teaspoonful.

Compound Pills of Iodide of Mercury.

Green Iodide of Mercury,	10 gr.
Guaiac Resin,	40 gr.
Extract of Gentian,	80 gr.

Triturate the Guaiac Resin into a mass with a little Alcohol; then incorporate with it the Extract and Iodide of Mercury, and divide into 20 pills.

Cream for Chilblains.

(Vance's.)

Nitrate of Mercury Ointment,	1 oz. (troy).
Camphor,	60 gr.
Oil of Turpentine,	2 fl. dr.
Olive Oil,	4 fl. dr.

Mix well. To be applied with gentle friction before the chilblains break.

ANTIMONY SALTS.

Unguentum Antimonii. *U. S.* 1870.

ANTIMONIAL OINTMENT.

Tartrate of Antimony and Potassium,	100 gr.
Lard,	400 gr.

Rub the Tartrate of Antimony and Potassium with the Lard, gradually added, until they are thoroughly mixed.

Antimonial and Saline Mixture.

(Prof. Gross's.)

Antimony and Potassium Tartrate,	2½ gr.
Magnesium Sulphate,	2 oz. (troy).
Morphine Sulphate,	1½ gr.
Aromatic Sulphuric Acid,	30 min.
Tincture of Veratrum Viride,	90 min.
Syrup of Ginger,	2 fl. oz.
Distilled Water,	10 fl. oz.

Mix. Average dose, a tablespoonful; to be diminished in case of vomiting or much nausea.

Antimonial Powder.

(Tyson's.)

Antimony Oxide,	20 gr.
Calcium Phosphate,	180 gr.

Mix. Dose, 5 to 10 grains.

Emplastrum Antimonii. *U. S.* 1870.

ANTIMONIAL PLASTER.

Tartrate of Antimony and Potassium, in fine powder,	1 oz. (troy).
Burgundy Pitch,	4 oz. (troy).

Melt the Pitch by means of a water-bath, and strain; then add the powder, and stir them well together until the mixture thickens on cooling.

ARSENIC SALTS.

Solution of Arsenite of Sodium.

(Harle's Solution.)

Arsenious Acid,	15 gr.
Sodium Carbonate (Exsiccated),	15 gr.
Cinnamon Water,	1 fl. oz.
Distilled Water, sufficient to make	4 fl. oz.

Boil the solids with 3 fl. oz. of Distilled Water until they are dissolved, make up the measure of 3 fl. oz. with Distilled Water, and add the Cinnamon Water. Dose, 4 minims.

Solution of Bromide of Arsenic.

(Clemens's.)

Arsenious Acid,	80 gr.
Potassium Carbonate,	80 gr.
Bromine,	160 gr.
Distilled Water,	15½ oz.

Boil the Potassium Carbonate and the Acid with most of the Water until dissolved; when cold, add the Bromine, and Water enough to make the prescribed quantity. It is said to improve by age, owing to the combination of the Bromine. Dose, 1 to 4 drops, in water, once or twice daily.

Solution of Arseniate of Ammonium.

(Biette's Arsenical Solution.)

Arseniate of Ammonium,	2 gr.
Distilled Water,	2 fl. oz.

Mix. Dose, 20 drops.

Solution of Arsenic Chlorophosphide.

Arsenious Acid,	4 gr.
Phosphorus,	8 gr.
Diluted Hydrochloric Acid,	12 gr.
Water, sufficient to make	18 fl. oz.

Mix. Digest on a water-bath for twenty-four hours, and decant the supernatant liquid.

Painless Caustic.

(Esmarch's.)

Arsenious Acid,	2 gr.
Morphine Sulphate,	2 gr.
Mild Chloride of Mercury,	16 gr.
Powdered Acacia,	96 gr.

Mix.

BISMUTH SALTS.

Oxide of Bismuth Ointment.

(McCall Anderson.)

Bismuth Oxide,	50 gr.
Oleic Acid,	1 fl. oz.
White Wax,	150 gr.
Vaseline,	1 oz. (troy).
Oil of Rose,	1 min.

Mix.

Carbonate of Bismuth Mixture.

Bismuth Subcarbonate,	120 gr.
Cinnamon Water,	2 fl. oz.
Syrup of Acacia,	2 fl. oz.

Mix them. A teaspoonful for infants in cholera infantum.

183. Glyceritum Bismuthi. *N. F.*

Glycerite of Bismuth.

Liquor Bismuthi Concentratus. Concentrated Solution of Bismuth.

Subnitrate of Bismuth,	1480 gr.
Nitric Acid,	4 tr. oz.
Citric Acid,	1200 gr.
Water of Ammonia,	a sufficient quantity.
Glycerin,	8 fl. oz.
Water,	enough to make 16 fl. oz.

Dissolve the Subnitrate of Bismuth in the Nitric Acid mixed with an equal volume of Water. Add the Citric Acid previously dissolved in *four* (4) *fluidounces* of Water. Divide the solution into two equal portions. To one portion add Water of Ammonia until the precipitate first formed is redissolved, and then dilute with Water to *eight* (8) *pints*. To this add the reserved portion, stirring constantly. Let the mixture stand about six hours, then transfer it to a paper filter, inside of a muslin strainer, both being folded together. Wash the precipitate with Water, until it is free from Nitric Acid, and by gentle pressure remove as much of the Water as possible. Dissolve the precipitate in a sufficient quantity of Water of Ammonia, evaporate the solution on the water-bath, in a tared capsule, to *eight* (8) *troyounces*, then transfer it to a graduate, allow it to cool, and wash the capsule with a little Water so as to make the whole volume of liquid measure *eight* (8) *fluidounces*. Finally, add the Glycerin, and filter, if necessary.

Glycerite of Bismuth, when required for immediate use, may also be prepared as follows:

Citrate of Bismuth and Ammonium,	2048 gr.
Stronger Water of Ammonia,	a sufficient quantity.
Glycerin,	8 fl. oz.
Water,	enough to make 16 fl. oz.

Triturate the Citrate of Bismuth and Ammonium with *six* (6) *fluidounces of* Water and *four* (4) *fluidounces* of Glycerin, and add to it gradually just enough Stronger Water of Ammonia to dissolve the salt, and to produce a neutral solution. Then add the remainder of the Glycerin and enough Water to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 16 *grains of Citrate of Bismuth and Ammonium.*

Note.—When this preparation is directed as an ingredient in other preparations, which are required to be filtered when completed, it may be added to them without previous filtration.

If Glycerite of Bismuth should at any time deposit a precipitate, this may be redissolved by the addition of just sufficient Stronger Water of Ammonia.

207. Liquor Bismuthi. *N. F.*

Solution of Bismuth.

Liquid Bismuth.

Glycerite of Bismuth,	2 fl. oz.
Alcohol,	2 fl. oz.
Distilled Water,	12 fl. oz.

Mix the Glycerite of Bismuth with *twelve* (12) *fluidounces* of Distilled Water, then add the Alcohol.

Solution of Bismuth may also be prepared in the following manner:

Citrate of Bismuth and Ammonium,	128 gr.
Alcohol,	2 fl. oz.
Water of Ammonia,	a sufficient quantity.
Distilled Water,	enough to make 16 fl. oz.

Dissolve the Citrate of Bismuth and Ammonium in *thirteen* (13) *fluidounces* of Distilled Water, and allow the solution to stand a short time. Should any insoluble matter have deposited, pour off the clear liquid and add just enough Water of Ammonia to the residue to dissolve it, or to cause it to retain a faint odor of Ammonia. Then filter the united liquids, add the Alcohol, and enough Distilled Water to make *sixteen* (16) *fluidounces*.

This preparation should be freshly made when wanted for use.

Each fluidrachm represents 1 *grain of Citrate of Bismuth and Ammonium.*

Glycerole of Bismuth Nitrate.

Bismuth Nitrate (Cryst.),	120 gr.
Glycerin,	1 fl. oz.

Dissolve the Bismuth Nitrate in the Glycerin, without heat.

Bismuth Catarrh Snuff.

Bismuth Subnitrate,	360 gr.
Morphine Hydrochlorate,	2 gr.
Acacia,	120 gr.

Mix.

9. Bismuthi Oxidum Hydratum. *N. F.*

Hydrated Oxide of Bismuth.

Subnitrate of Bismuth,	6 tr. oz.
Nitric Acid,	10 tr. oz.
Water of Ammonia,	12 tr. oz.
Bicarbonate of Sodium,	1 tr. oz.
Distilled Water,	a sufficient quantity.

Mix the Subnitrate of Bismuth with *four* (4) *fluidounces* of Distilled Water in a quart flask, add *nine* (9) *troyounces* of Nitric Acid, and promote the solution of the salt by agitation, and, if necessary, by a gentle heat. Pour the solution into *one* (1) *gallon* of Distilled Water previously acidulated with *one* (1) *troyounce* of Nitric Acid, and filter the liquid through absorbent cotton. Mix the Water of Ammonia with *two* (2) *gallons* of Distilled Water in a glazed vessel of double that capacity, and pour into it, slowly and with constant stirring, the bismuth solution. Let the mixture stand during four hours so that the precipitate may subside, then pour off the supernatant liquid, and wash the precipitate four times more by decantation with Distilled Water, the Bicarbonate of Sodium being dissolved in the last wash-water. Pour the precipitate upon a wetted muslin strainer, and wash it with Distilled Water, until the washings run off tasteless. Transfer the strainer to a warm place, so that the precipitate may dry. Then rub the latter to powder and keep it in well-stoppered bottles.

Note.—Hydrated Oxide of Bismuth is sometimes demanded in the form of a creamy mixture with water, under the name of *Cremor Bismuthi* or *Cream of Bismuth*. This may be prepared by triturating 20 parts of the Oxide with 80 parts of Water.

32. Elixir Bismuthi. *N. F.*

Elixir of Bismuth.

Citrate of Bismuth and Ammonium,	256 gr.
Water, hot,	1 fl. oz.
Water of Ammonia, a sufficient quantity.	
Aromatic Elixir, enough to make 16 fl. oz.	

Dissolve the Citrate of Bismuth and Ammonium in the hot Water, allow the solution to stand until any undissolved matter has subsided; then decant the clear liquid, and add to the residue just enough Water of Ammonia to dissolve it. Then mix it with the decanted portion and add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm represents 2 grains of Citrate of Bismuth and Ammonium.

UNOFFICIAL PREPARATIONS OF ORGANIC SUBSTANCES.

CELLULIN.

Aromatic Vinegar.

Glacial Acetic Acid,		
Oil of Cloves,		
Camphor,	of each,	1 fl. oz.

Mix.

1. Acetum Aromaticum. *N. F.*

Aromatic Vinegar.

Oil of Lavender,	4 min.
Oil of Rosemary,	4 min.
Oil of Juniper,	4 min.
Oil of Peppermint,	4 min.
Oil of Cinnamon (Cassia),	4 min.
Oil of Lemon,	8 min.
Oil of Cloves,	8 min.
Alcohol,	3 fl. oz.
Acetic Acid (U. S. P.),	4 fl. oz.
Water,	enough to make 16 fl. oz.

Dissolve the Oils in the Alcohol, add the Acetic Acid, and, lastly, enough Water to make *sixteen* (16) *fluidounces*. Warm the turbid mixture, during several hours, at a temperature not exceeding 70° C. (158° F.), taking care that it shall not suffer loss by evaporation. Then set it aside for a few days, occasionally agitating, and filter.

189. Gossypium Stypticum. *N. F.*

Styptic Cotton.

Purified Cotton,	
Solution of Chloride of Iron,	
Glycerin,	
Water, each,	a sufficient quantity.

Mix the liquids in the proportion of *five* (5) *parts* of the Iron Solution, *one* (1) *part* of Glycerin, and *four* (4) *parts* of Water, in such quantities that the Purified Cotton shall be completely immersed in the liquid when gently pressed. Allow the Cotton to remain in the liquid one hour, then remove it, press it, until it has been brought to *twice* its original weight, spread it out in thin layers, in a warm place, protected from dust and light, and when it is sufficiently dry, transfer it to well-closed receptacles.

Liquor Picis Carbonis.

Solution of Coal-Tar.

Liquor Carbonis Detergens.

Coal-Tar,	4 oz. av.
Tinct. Quillayæ (N.F.),	8 fl. oz.
Alcohol,	8 fl. oz.

Digest for two days, decant, and filter.

112. Emplastrum Picis Liquidæ Compositum. *N. F.*

Compound Tar Plaster.

Resin,	25 parts.
Tar,	20 parts.
Podophyllum, in No. 60 powder,	5 parts.
Phytolacca Root, in No. 60 powder,	5 parts.
Sanguinaria, in No. 60 powder,	5 parts.

Melt the Resin and Tar together, then stir in the mixed powders, and as the mass cools, mould it into rolls, or pour it into boxes.

87. Elixir Picis Compositum. *N. F.*

Compound Elixir of Tar.

Syrup of Wild Cherry,	8 fl. oz.
Syrup of Tolu,	8 fl. oz.
Sulphate of Morphine,	2½ gr.
Methylic Alcohol,	360 min.
Water,	a sufficient quantity.
Wine of Tar,	enough to make 16 fl. oz.

Dissolve the Sulphate of Morphine in about *one* (1) *fluidrachm* of hot Water, and add the solution to the two Syrups previously mixed. Then add the Methylic Alcohol and enough Wine of Tar to make *sixteen* (16) *fluidounces.*

Each fluidrachm contains about $\frac{1}{50}$ grain of Sulphate of Morphine.

Note.—Much of the commercial "Wood Spirit" or "Wood Naphtha" is unfit for medicinal purposes. Refined Wood Naphtha or Methylic Alcohol should be colorless and freely miscible to a clear liquid with water, alcohol, and ether. Its odor, which is characteristic, should be free from empyreuma. It should contain at least 90 per cent. of absolute Methylic Alcohol, which corresponds to a specific gravity of 0·846 at 15° C. (59° F.). On mixing methylic alcohol cautiously with one-fourth its volume of sulphuric acid, the liquid should remain colorless or acquire not more than a very pale yellowish-red tint; and on gently heating methylic alcohol with an equal volume of a 10 per cent. solution of potassa, the mixture should not acquire a brown color.

260. Mistura Olei Picis. *N. F.*

Mixture of Oil of Tar.

Mistura Picis Liquidæ. Tar Mixture.

Purified Extract of Glycyrrhiza,	1 tr. oz.
Oil of Tar,	½ fl. oz.
Sugar,	4 tr. oz.
Chloroform,	75 min.
Oil of Peppermint,	20 min.
Alcohol,	2½ fl. oz.
Water,	enough to make 16 fl. oz.

Add the Purified Extract of Glycyrrhiza and the Sugar to *ten* (10) *fluidounces* of Water, contained in a covered vessel, and heat the mixture to boiling until the Extract and Sugar are dissolved. Then add the Oil of Tar, cover the vessel, and allow the contents to cool, stirring occasionally. Next add the Chloroform and Oil of Peppermint, previously dissolved in the Alcohol, and, lastly, enough Water to make *sixteen* (16) *fluidounces.*

This mixture should be well agitated whenever any of it is to be dispensed.

229. Liquor Picis Alkalinus. *N. F.*

Alkaline Solution of Tar.

Tar,	4 tr. oz.
Potassa,	2 tr. oz.
Water,	10 fl. oz.

Dissolve the Potassa in the Water. Shake the solution with the Tar so that the latter may be dissolved, and strain the solution through muslin.

422. Unguentum Picis Compositum. *N. F.*

Compound Tar Ointment.

Oil of Tar,	4 parts.
Tincture of Benzoin,	2 parts.
Oxide of Zinc,	8 parts.
Yellow Wax,	26 parts.
Lard,	32 parts.
Cotton-Seed Oil,	35 parts.

Melt the Yellow Wax and Lard with the Cotton-Seed Oil at a gentle heat. Add the Tincture of Benzoin, and continue heating until all the alcohol has evaporated. Then withdraw the heat, add the Oil of Tar, and, finally, the Oxide of Zinc, incorporating the latter thoroughly, so that, on cooling, a smooth, homogeneous ointment may result.

433. Vinum Picis. *N. F.*

Wine of Tar.

Tar,	1½ tr. oz.
Water,	4 fl. oz.
Pumice, in moderately fine powder,	2 tr. oz.
Stronger White Wine,	enough to make 16 fl. oz.

Upon the Tar contained in a suitable vessel pour *four* (4) *fluidounces* of cold Water, and triturate the mixture thoroughly; then pour off the Water and throw it away. Mix the remaining Tar thoroughly with the powdered Pumice, and add *sixteen* (16) *fluidounces* of Stronger White Wine. Stir frequently during four hours, then transfer the mixture to a wetted filter, and, after the liquid has passed, pour on enough Stronger White Wine to make the filtrate measure *sixteen* (16) *fluidounces.*

Camphorated Acetic Acid.

Camphor,	1 oz. (av.).
Acetic Acid,	16 fl. oz.

Powder the Camphor with the aid of alcohol, and dissolve it in the Acetic Acid.

Raspberry Vinegar.

Raspberry Syrup,	16 fl. oz.
Glacial Acetic Acid,	1 fl. dr.

Mix. Dilute with sufficient water.

Acetone Mixture.

(Dr. W. L. Atlee.)

Acetone,	1 fl. dr.
Camphorated Tincture of Opium,	1 fl. oz.
Wine of Antimony,	1 fl. oz.
Wine of Tar,	2 fl. oz.

Mix. Dose, a teaspoonful.

187. Glyceritum Picis Liquidæ. *N. F.*

Glycerite of Tar.

Tar,	1 tr. oz.
Carbonate of Magnesium,	2 tr. oz.
Glycerin,	4 fl. oz.
Alcohol,	2 fl. oz.
Water, enough to make	16 fl. oz.

Upon the Tar, contained in a mortar, pour *three* (3) *fluidounces* of cold Water, stir them thoroughly together, and pour off the Water. Repeat this once or twice, until the Water only feebly reddens blue litmus-paper. Now triturate the washed Tar with the Alcohol, gradually incorporate the Carbonate of Magnesium and Glycerin, and, lastly, *ten* (10) *fluidounces* of Water. Pour the mixture upon a filter of loose texture spread over a piece of straining muslin, and, after the liquid portion has passed through, wash the residue on the filter with Water, until the whole filtrate measures *sixteen* (16) *fluidounces.*

Infusum Picis Liquidæ. *U. S.* 1870.

INFUSION OF TAR. (TAR WATER.)

Tar,	4 oz. (troy).
Water,	16 fl. oz.

Mix them, and shake the mixture frequently during twenty-four hours; then pour off the infusion, and filter through paper.

Alkaline Solution of Tar.

(Dr. L. D. Bulkley.)

Tar,	2 fl. dr.
Potassa,	60 gr.
Distilled Water,	5 fl. dr.

Mix.

Carbolate of Iodine.

(Dr. Holtz's formula.)

Carbolic Acid (Cryst.),	60 gr.
Alcohol,	1 fl. dr.
Tincture of Iodine,	4 fl. dr.
Water,	5 fl. dr.

Mix.

Aqua Acidi Carbolici. *U. S.* 1870.

CARBOLIC ACID WATER.

Glycerite of Carbolic Acid,	5 fl. dr.
Water, a sufficient quantity to make	8 fl. oz.

Mix the Glycerite with the Water. Used as a gargle, and as a wash in various skin-diseases.

Glycerite of Birch Tar.

Birch Tar,	1 oz. (troy).
Glycerin,	8 fl. oz.

Dilute the Glycerin with one-fifth of its volume of water, and mix.

Unguentum Creasoti. *U. S.* 1870.

OINTMENT OF CREASOTE.

Creasote,	1 fl. dr.
Lard,	2 oz. (troy).

Mix thoroughly.

Dobell's Solution.

Carbolic Acid,	45 min.
Sodium Borate,	60 gr.
Sodium Bicarbonate,	60 gr.
Glycerin,	1 fl. oz.
Water, sufficient to make	16 fl. oz.

Glyceritum Acidi Carbolici. *U. S.* 1870.

GLYCERITE OF CARBOLIC ACID.

Carbolic Acid,	2 oz. (troy).
Glycerin,	8 fl. oz.

Rub them together in a mortar until the Acid is dissolved.

275. Oleum Carbolatum. *N. F.*

Carbolized Oil.

Carbolic Acid,	5 parts.
Cotton-Seed Oil,	95 parts.

Melt the Carbolic Acid with a gentle heat, and mix it with the Cotton-Seed Oil.

2. Acidum Carbolicum Iodatum. *N. F.*

Iodized Carbolic Acid.

Phenol Iodatum. Iodised Phenol.

Iodine, reduced to powder,	20 parts.
Carbolic Acid,	76 parts.
Glycerin,	4 parts.

Introduce the Iodine into a flask, add the Carbolic Acid, previously melted, and the Glycerin, and digest the mixture at a gentle heat, frequently agitating, until the Iodine is dissolved.

Keep the product in glass-stoppered vials, in a dark place.

Carbolized Jute.

Carbolic Acid (Cryst.),	350 gr.
Paraffin,	350 gr.
Resin,	1400 gr.
Benzin,	24 fl. oz.

Make a solution and saturate 16 oz. of jute with it.

14. Carbasus Carbolata. *N. F.*

Carbolized Gauze.

Resin, in coarse powder,	40 parts.
Castor Oil,	5 parts.
Carbolic Acid,	10 parts.
Alcohol,	225 parts.
Gauze Muslin,	a sufficient quantity.

Dissolve the Resin, Castor Oil, and Carbolic Acid in the Alcohol. Then immerse in the mixture loosely-folded pieces of Gauze Muslin, allow them to become thoroughly saturated, then take them out and press out the excess of liquid, until the weight of the impregnated Gauze amounts to *one hundred and seventy* (170) *parts* for every *one hundred* (100) *parts* of the original fabric. Spread out the pieces horizontally, and as soon as the Alcohol has nearly all evaporated, fold and wrap the pieces in paraffin paper, and preserve them in air-tight receptacles.

The impregnated Gauze, when dry, contains about 2·5 per cent. of Carbolic Acid.

Note.—The most suitable brands of Gauze Muslin for making carbolized or other antiseptic gauze, are those known in the market as "Stillwater," or "Lehigh E."

Collodion for Corns.

(Gezow's.)

Salicylic Acid,	45 gr.
Extract of Indian Hemp,	8 gr.
Collodion,	6 fl. dr.

Dissolve.

24. Elixir Acidi Salicylici. *N. F.*

Elixir of Salicylic Acid.

Salicylic Acid,	640 gr.
Citrate of Potassium,	2 tr. oz.
Glycerin,	8 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Citrate of Potassium in the Glycerin with the aid of a gentle heat. Add the Salicylic Acid, and continue the heat until it is dissolved. Then add enough Aromatic Elixir to make *sixteen* (16) *fluidounces.*

This Elixir should be freshly made when wanted for use.

Each fluidrachm contains 5 grains of Salicylic Acid.

Salicylic Mixture.

(Thiersch's.)

Salicylic Acid,	80 gr.
Syrup of Orange Peel,	2 fl. oz.
Alcohol,	3 fl. oz.
Water, sufficient to make	10 fl. oz.

Mix. Dose, a teaspoonful.

Liebig's Corn Collodion.

Salicylic Acid,	5 gr.
Extract of Indian Hemp,	80 gr.
Collodion,	5 fl. dr.

Mix and dissolve.

Salicylic Acid Cotton.

Purified Cotton,	600 gr.
Salicylic Acid,	60 gr.
Alcohol,	10 fl. dr.
Glycerin,	6 min.

Dissolve the Salicylic Acid in the Alcohol, add the Glycerin to this solution, and saturate the Cotton with the liquid; press out the superfluous liquid, and dry.

Charcoal and Blue Mass Mixture.

Sodium Bicarbonate,	80 gr.
Charcoal,	60 gr.
Mass of Mercury,	8 gr.
Aromatic Syrup of Rhubarb,	2 fl. oz.
Water,	2 fl. oz.

Triturate together into a uniform mixture. Dose, a tablespoonful.

21. Collodium Salicylatum Compositum. *N. F.*

Compound Salicylated Collodion.

Corn Collodion.

Salicylic Acid,	11 parts
Extract of Indian Cannabis,	2 parts.
Alcohol,	10 parts.
Flexible Collodion, enough to make	100 parts.

Dissolve the Extract of Indian Cannabis in the Alcohol, and the Salicylic Acid in about *fifty* (50) *parts* of Flexible Collodion contained in a tared bottle. Then add the former solution to the latter, and finally add enough Flexible Collodion to make *one hundred* (100) *parts.*

18. Collodium Iodatum. *N. F.*

Iodized Collodion.

Iodine, reduced to powder,	5 parts.
Flexible Collodion,	95 parts.

Introduce the Iodine into a bottle, add the Flexible Collodion and agitate until the Iodine is dissolved.

19. Collodium Iodoformatum. *N. F.*

Iodoform Collodion.

Iodoform,	5 parts.
Flexible Collodion,	95 parts.

Dissolve the Iodoform in the Flexible Collodion by agitation.

20. Collodium Tiglii. *N. F.*

Croton Oil Collodion.

Croton Oil,	10 parts.
Flexible Collodion,	90 parts.

Mix them.

Charcoal Poultice.

(Thomsonian name.)

Charcoal,	1 oz. (troy).
Ginger, Bayberry, of each,	240 gr.
Elm,	1 oz. (troy).
Hot Water, sufficient.	

Mix.

Naphthol Ointment.

(Hardy's.)

Naphthol,	120 gr.
Vaseline,	2¼ oz. (troy).

Dissolve the Naphthol in half its weight of Ether; mix this solution with a portion of the Vaseline, and heat to about 40° C. (104° F.) until the Ether is completely evaporated; then add the remainder of the Vaseline, and triturate thoroughly; finally, preserve the ointment in a well-covered vessel.

Naphthol Salve.

(Kaposi's.)

Naphthol,	180 gr.
Green Soap,	600 gr.
Prepared Chalk,	120 gr.
Lard,	2¼ oz. (av.).

Mix. Used in itch. The affected part to be rubbed twice a day.

AMYLACEOUS AND MUCILAGINOUS SUBSTANCES.

Soluble Iodide of Starch.

Iodine,	360 gr.
Starch,	6 oz. (troy).
Ether,	10 fl. dr.

Dissolve the Iodine in the Ether, pour the solution over the Starch; then triturate till the Ether is evaporated; introduce into a water-bath, and continue the heat for half an hour with occasional stirring. A portion of the Iodine vapor has escaped, but the Starch, which has now become soluble, will be combined with about 4 per cent. of Iodine.

80. Elixir Malti et Ferri. *N. F.*

Elixir of Malt and Iron.

Extract of Malt,	4 fl. oz.
Phosphate of Iron (U. S. P. 1880),	128 gr.
Water,	½ fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Phosphate of Iron in the Water by the aid of heat, mix the solution with the Extract of Malt previously introduced into a graduated bottle, and add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Set the mixture aside for twenty-four hours, and filter.

Each fluidrachm represents 1 *grain of Phosphate of Iron and* 15 *grains of Extract of Malt.*

Note.—Extract of Malt, most suitable for this preparation, should have about the consistence of Balsam of Peru, at a temperature of about 15° C. (59° F.). The filtration of this preparation will be greatly facilitated by allowing the mixture to stand a few days before pouring it on the filter.

Decoctum Hordei. *U. S.* 1870. Decoction of Barley.

Barley,	240 gr.
Water, sufficient.	

Having washed away extraneous matters which adhere to the Barley, boil it with 2 fl. oz. of Water for a short time, and throw away the resulting liquid; then, having poured on it 16 fl. oz. of boiling Water, boil down to 8 fl. oz., and strain.

160. Extractum Malti Fluidum. *N. F.*

Fluid Extract of Malt.

Malt,	16 tr. oz.
Alcohol,	
Water, each,	a sufficient quantity.

Reduce the Malt to a coarse powder, not finer than No. 20. Moisten it with *eight* (8) *fluidounces* of a mixture of *one* (1) *volume* of Alcohol and *three* (3) *volumes* of Water, and set it aside, well covered, until it has ceased to swell. Then mix it with as much of the menstruum as it will take up without dripping, pack it uniformly, but without pressure, in a percolator, and add enough of the before-mentioned menstruum to cover it. When the liquid begins to drop from the orifice, close the latter, and allow the contents to macerate during twenty-four hours, adding from time to time more menstruum, if necessary, to keep the malt just covered. Then remove the cork and allow the percolation to proceed until the percolate weighs *twelve* (12) *troyounces*. Set this aside, well corked, until any suspended matters have been deposited. Then decant the clear liquid and preserve it for use.

Note.—The product thus obtained may be regarded as being practically equivalent to the drug in the proportion of minim for grain, the apparent excess of dissolved matters present in the first portions of the percolate being about offset by the soluble matters still remaining in the drug when the percolation is interrupted.

Care should be exercised to keep this preparation in well-stoppered bottles in a cool, dark place.

Syrup of Iodide of Starch.

Iodide of Starch (soluble),	360 gr.
Sugar,	19 oz. (troy).
Water,	12 fl. oz.

Dissolve the Iodide in the Water, and add the Sugar. This syrup contains 1 part of Iodine in 1000. Dose, a teaspoonful.

Infusum Lini Compositum. *U. S.* 1870. Compound Infusion of Flaxseed.

Flaxseed,	½ oz. (troy).
Glycyrrhiza (bruised),	120 gr.
Boiling Water,	16 fl. oz.

Macerate for two hours in a covered vessel, and strain.

Conserve of Hollyhock.

(Thomsonian name.)

Poplar Bark,	120 gr.
Bayberry,	120 gr.
Hydrastis,	120 gr.
Cloves,	120 gr.
Cinnamon,	120 gr.
Cypripedium,	120 gr
Capsicum,	60 gr.
Oil of Pennyroyal,	1 fl. dr.
Hollyhock Flowers,	4 oz. (troy).

Pound, and form into balls of the size of small marbles.

247. Mistura Acaciæ. *N. F.*

Mixture of Acacia.

Mixtura Gummosa (*Germ. Pharm.*, I.).

Acacia, in fine powder,	1 tr. oz.
Sugar,	1 tr. oz.
Water,	12 fl. oz.

Dissolve the Acacia and Sugar in the Water.

This preparation should be freshly made when wanted for use.

307. Pulvis Acaciæ Compositus. *N. F.*

Compound Powder of Acacia.

Pulvis Gummosus (*Germ. Pharm.*).

Acacia, in fine powder,	15 parts.
Glycyrrhiza, in fine powder,	10 parts.
Sugar, in fine powder,	5 parts.

Mix them intimately.

188. Glyceritum Tragacanthæ. *N. F.*

Glycerite of Tragacanth.

Tragacanth, in fine powder,	2 tr. oz.
Glycerin,	12½ fl. oz.
Water,	8 fl. oz.

Triturate the Tragacanth with the Glycerin in a mortar, add the Water, and continue the trituration, until a homogeneous, thick paste results.

Note.—The *Glyceritum Tragacanthæ* of the British Pharm. is prepared by mixing 3 troyounces of Tragacanth with 12 fluidounces of Glycerin in a mortar, adding 2 fluidounces of Water, and triturating until a translucent, homogeneous jelly is formed.

Mucilago Tragacanthæ of the U. S. Pharm. (1880) is made by mixing 18 parts of Glycerin with 76 parts of Water, heating the mixture to boiling, adding 6 parts of Tragacanth, macerating for twenty-four hours, then adding Water to make 100 parts, beating it to a uniform consistence, and straining.

Unguentum Glycerini of the German Pharm. is prepared by triturating 1 part of Powdered Tragacanth with 5 parts (by weight) of Alcohol (of about 91 per cent.), then adding 50 parts of Glycerin, and heating on a steam-bath.

181. Gelatinum Chondri. *N. F.*

Chondrus Gelatin.

Chondrus,	1 part.
Water,	a sufficient quantity.

Wash the Chondrus with cold Water, then place it in a suitable vessel, add *fifty* (50) *parts* of hot Water, and heat it on a boiling water-bath for fifteen minutes, frequently stirring. Strain the decoction, while hot, through a strong muslin strainer; return the strained, mucilaginous liquid to the water-bath, evaporate it to a semi-fluid consistence, then transfer it to shallow, flat-bottomed trays, and evaporate it at a temperature not exceeding 90° C. (194° F.), so that the Gelatin may become detached in scales.

Note.—Chondrus Gelatin thus prepared furnishes a Mucilage of Chondrus which is opaque, like that made directly from the Chondrus itself. It may be prepared so as to yield a transparent mucilage by following the plan pointed out in the *Note* to *Mucilago Chondri*.

266. Mucilago Chondri. *N. F.*

Mucilage of Chondrus.

Chondrus,	360 gr.
Water,	enough to make 30 fl. oz.

Wash the Chondrus with cold Water, then place it in a suitable vessel, add *thirty* (30) *fluidounces* of Water, and heat it, on a boiling water-bath, for fifteen minutes, frequently stirring. Then strain it through muslin, and pass enough Water through the strainer to make the liquid, when cold, measure *thirty* (30) *fluidounces*.

Mucilage of Chondrus may also be prepared in the following manner:

Chondrus Gelatin,	240 gr.
Water,	enough to make 30 fl. oz.

Heat the Chondrus Gelatin with *thirty* (30) *fluidounces* of Water, at a boiling temperature, until it is completely dissolved. Then allow the solution to cool, and add enough Water, if necessary, to make up the volume to *thirty* (30) *fluidounces*.

Note.—Mucilage of Chondrus, thus prepared, is well adapted for the preparation of emulsions of fixed oils. If it is, however, required for admixture with *clear* liquids, it should be diluted, when freshly made, and while still hot, with about 3 volumes of boiling water, filtered, and the filtrate evaporated to the volume corresponding to the proportions above given. The filtration may be greatly facilitated by filling the filter loosely with absorbent cotton, and pouring the liquid upon the latter.

Mucilage of Chondrus may be preserved for some time by transferring it, while hot, into bottles, which should be filled to the neck, then pouring a layer of Olive Oil on top, securely stoppering the bottles, and keeping them, in an upright position, in a cool place. When the Mucilage is wanted for use, the layer of oil may be removed by means of absorbent cotton.

267. Mucilago Dextrini. *N. F.*

Mucilage of Dextrin.

Dextrin,	1 part.
Water,	enough to make 8 parts.

Mix them in a tared vessel, and heat the mixture, under constant stirring, to near boiling, until the Dextrin is dissolved and a limpid liquid results. Then restore any loss of water by evaporation, strain the

liquid through muslin, and allow it to cool short of gelatinizing, when it will be ready for immediate use.

Note.—If the Mucilage is not at once to be used for preparing emulsions or other mixtures, transfer it, while hot, to bottles, which should be filled to the neck. Then pour into each bottle a sufficient quantity of Olive Oil to form a protecting layer, and when the mucilage has gelatinized, securely cork the bottles, and keep them in a cool place, in an upright position.

When gelatinized Mucilage of Dextrin is to be used for the preparation of emulsions or for other mixtures, pour off the protecting layer of oil from the surface, remove the remainder of the oil by a pellet of absorbent cotton, and warm the bottle gently until the Mucilage is liquefied. Then allow it to cool short of gelatinizing.

The kind of Dextrin suitable for this preparation is the commercial, *white* variety, provided it still contains some unaltered or only partially altered starch, and forms a jelly on cooling, when made into a mucilage after the formula above given. The yellow variety, which is completely soluble in about 2 parts of cold water, will not answer the purpose.

268. Mucilago Salep. *N. F.*

Mucilage of Salep.

Salep, in fine powder,	70 gr.
Cold Water,	1½ fl. oz.
Boiling Water,	14½ fl. oz.

Place the powdered Salep into a flask containing the Cold Water, and shake until the powder is divided. Then add the Boiling Water, and shake the mixture continuously until it has cooled to 25° C. (77° F.), or below this temperature. The cooling may be hastened by frequent and brief immersion of the flask in cold water.

Mucilage of Salep should be freshly made when wanted for use.

Note.—If Sugar or Syrup is prescribed in the same mixture with Mucilage of Salep, it is preferable to triturate the required quantity of powdered Salep with either of the former, as the case may be, and then to add rapidly the proportionate amount of Boiling Water.

359. Syrupus Chondri Compositus. *N. F.*

Compound Syrup of Chondrus.

Compound Syrup of Irish Moss.

Chondrus,	8 gr.
Fluid Extract of Ipecac,	8 min.
Fluid Extract of Squill,	120 min.
Fluid Extract of Senega,	120 min.
Camphorated Tincture of Opium,	210 min.
Purified Talcum,	120 gr.
Sugar,	10 tr. oz.
Water, enough to make	16 fl. oz.

Macerate the Chondrus in *one* (1) *fluidounce* of Water until it is softened, then heat it on a boiling water-bath for fifteen minutes, strain it through flannel, without pressure, and wash the flannel and contents with *one* (1) *fluidounce* of hot Water. Mix the Fluid Extracts and Tincture with the Purified Talcum and *five* (5) *fluidounces* of Water, shake the mixture frequently and thoroughly during half an hour, and then filter it through a wetted filter, returning the first portions of the filtrate, until it runs through clear. Mix the mucilage of Chondrus with the filtrate, then add the Sugar, and pass enough Water through the filter to make the product, after the Sugar has been dissolved by agitation, measure *sixteen* (16) *fluidounces.*

407. Tinctura Persionis. *N. F.*

Tincture of Cudbear.

Cudbear, in fine powder,	2 tr. oz.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Pack the Cudbear in a suitable percolator, and percolate it with a mixture of *one* (1) *volume* of Alcohol and *two* (2) *volumes* of Water, until *sixteen* (16) *fluidounces* of Tincture are obtained.

Note.—This preparation is intended as a coloring agent when a bright red tint or color is to be produced, particularly in acid liquids.

408. Tinctura Persionis Composita. *N. F.*

Compound Tincture of Cudbear.

Cudbear,	120 gr.
Caramel,	1½ tr. oz.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Mix *one* (1) *volume* of Alcohol with *two* (2) *volumes* of Water. Macerate the Cudbear with *twelve* (12) *fluidounces* of the menstruum during twelve hours, agitating occasionally, and then filter through paper, and add the Caramel, previously dissolved in *two* (2) *fluidounces* of Water. Then pass enough of the before-mentioned menstruum through the filter to make the whole measure *sixteen* (16) *fluidounces.*

Note.—This preparation is intended as a coloring agent, when a brownish-red tint or color is to be produced.

332. Species Emollientes. *N. F.*

Emollient Species.

Emollient Cataplasm (*Germ. Pharm.*).

Althæa Leaves,	
Mallow Leaves,	
Melilot Tops,	
Matricaria,	
Flaxseed, each,	equal parts.

Reduce them to a coarse powder, and mix uniformly.

Note.—Mallow Leaves are derived from *Malva vulgaris* Fries, and *Malva sylvestris* Linné. Melilot Tops are the leaves and flowering branches of *Melilotus officinalis* Desrousseaux, and *Melilotus altissimus* Thuilliers.

SACCHARINE SUBSTANCES.

Syrup of Manna.

Manna,	1 oz. (troy).
Sugar,	5 oz. (troy).
Water,	4 fl. oz.

Dissolve the Manna in the Water, filter, add the Sugar, and heat to boiling, then strain.

Syrup of Liquorice Root.

Fluid Extract of Glycyrrhiza,	4 fl. oz.
Syrup, a sufficient quantity to make	16 fl. oz.

Mix.

70. Elixir Glycyrrhizæ. *N. F.*

Elixir of Glycyrrhiza.

Elixir of Liquorice.

Purified Extract of Glycyrrhiza, 1 tr. oz.
Water of Ammonia, a sufficient quantity.
Aromatic Elixir, enough to make 16 fl. oz.

Triturate the Purified Extract of Glycyrrhiza with *twelve* (12) *fluidounces* of Aromatic Elixir gradually added. To *ten* (10) *fluidounces* of this mixture add Water of Ammonia in drops, until it is in slight excess. Mix this with the reserved portion, and, finally, add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

71. Elixir Glycyrrhizæ Aromaticum. *N. F.*

Aromatic Elixir of Glycyrrhiza.

Aromatic Elixir of Liquorice.

Fluid Extract of Glycyrrhiza,	2 fl. oz.
Oil of Cloves,	6 min.
Oil of Cinnamon (Ceylon),	6 min.
Oil of Nutmeg,	4 min.
Oil of Fennel,	12 min.
Purified Talcum,	360 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Oils with the Purified Talcum and the Fluid Extract, then add *fourteen* (14) *fluidounces* of Aromatic Elixir, filter, and pass enough Aromatic Elixir through the filter to make *sixteen* (16) *fluidounces*.

151. Extractum Glycyrrhizæ Depuratum. *N. F.*

Purified Extract of Glycyrrhiza.

Purified Extract of Liquorice.

Extract of Glycyrrhiza, in sticks,
Water, each, a sufficient quantity.

Put a layer of well-washed rye-straw over the bottom of a keg or other suitable tall vessel. Then put a single layer of sticks of Extract of Glycyrrhiza, broken into coarse pieces, over it. Continue to put in alternate layers of straw and Extract of Glycyrrhiza until the vessel is full or the whole of the Extract has been disposed of. Fill the vessel with cold Water, and allow it to remain for three days. Then draw off the solution which has formed, by means of a faucet, or siphon, or otherwise, refill the vessel with cold Water, and proceed as before. Mix the several solutions obtained, allow any suspended matter to subside, decant the clear solution, and strain the remainder without pressure. Finally, evaporate the liquid on a water-bath to the consistence of a pilular extract.

Note.—Purified Extract of Glycyrrhiza should not be confounded with the officinal Pure Extract of Glycyrrhiza (*Extractum Glycyrrhizæ Purum*).

369. Syrupus Glycyrrhizæ. *N. F.*

Syrup of Glycyrrhiza.

Syrup of Liquorice.

Pure Extract of Glycyrrhiza (U. S. P.),	2 tr. oz.
Glycerin,	2 tr. oz.
Sugar,	10 tr. oz.
Water, enough to make	16 fl. oz.

Dissolve the Pure Extract of Glycyrrhiza in *eight* (8) *fluidounces* of Water, add the Sugar, dissolve it by agitation, and strain. Then add the Glycerin, and, lastly, enough Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about 30 *grains of Glycyrrhiza.*

214. Liquor Extracti Glycyrrhizæ. *N. F.*

Solution of Extract of Glycyrrhiza.

Solution of Extract of Liquorice.

Purified Extract of Glycyrrhiza,	a sufficient quantity.
Alcohol,	2 fl. oz.
Glycerin,	4 fl. oz.
Water, enough to make	16 fl. oz.

In a small portion of Purified Extract of Glycyrrhiza, weighed into a tared capsule, determine the amount of water, by drying it to a constant weight. Then take of the Purified Extract a quantity equivalent to *four* (4) *troyounces* of dry extract, dissolve this, on a water-bath, in *four* (4) *fluidounces* of Water, add the Glycerin, and allow the liquid to cool. Lastly, add the Alcohol, and enough Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents 15 *grains of dry Extract of Glycyrrhiza.*

232. Liquor Saccharini. *N. F.*

Solution of Saccharin.

Saccharin,	512 gr.
Bicarbonate of Sodium,	240 gr.
Alcohol,	4 fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Saccharin and the Bicarbonate of Sodium in *ten* (10) *fluidounces*

of Water, filter the solution, add the Alcohol to the filtrate, and pass enough Water through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 4 *grains of Saccharin.*

Note.—The Saccharin directed in the above formula is, properly speaking, "anhydro-orthosulphamine-benzoic acid," an artificially prepared member of the so-called aromatic series of organic chemicals. It is a body having feebly acid properties, soluble in about 333 parts of water and in 33 parts of alcohol at 15° C. (59° F.). When neutralized by an alkali, it is quite soluble in water.

The Solution of Saccharin is intended to be used for sweetening liquids or solids, when the use of sugar is objectionable, or when a sweet taste is to be imparted to a liquid without increasing its density.

334. Species Pectorales. *N. F.*

Pectoral Species.

Species ad Infusum Pectorale. Breast Tea (*Germ. Pharm.*).

Althæa, peeled,	8 parts.
Coltsfoot Leaves,	4 parts.
Glycyrrhiza, Russian, peeled,	3 parts.
Anise,	2 parts.
Mullein Flowers,	2 parts.
Orris Root,	1 part.

Cut, bruise, and mix them.

Note.—Coltsfoot Leaves are derived from *Tussilago Farfara* Linné. Mullein Flowers are from *Verbascum Thapsus* G. Meyer.

Infusum pectorale (Pectoral Infusion, or Infusion of Pectoral Species) is made by infusing 1 troyounce of the above preparation, in the usual manner, so as to obtain 10 fluidounces of strained product.

Pectoral Lozenges.

(Dr. Jackson's.)

Powdered Ipecac,	5 gr.
Sulphurated Antimony,	2½ gr.
Morphine Hydrochlorate,	3 gr.
Powdered Acacia,	330 gr.
Powdered Sugar,	330 gr.
Powdered Extract of Glycyrrhiza,	330 gr.
Oil of Sassafras,	2 min.
Tincture of Tolu,	2 min.

To be made into a stiff mass with Simple Syrup, and divided into 100 lozenges, or into lozenges of 10 gr. each. Each lozenge contains $\frac{1}{20}$ gr. of Ipecac, $\frac{1}{40}$ gr. of Antimony, $\frac{1}{33}$ gr. of Morphine. One every three or four hours.

Pectoral Powder.

(Wedel's.)

Benzoic Acid,	8 gr.
Washed Sulphur,	75 gr.
Glycyrrhiza,	250 gr.
Iris,	30 gr.
Sugar,	300 gr.
Oil of Anise,	4 min.
Oil of Fennel,	4 min.

Mix. A tablespoonful three or four times a day in bronchitis, severe cough, or croup.

Cough Powder.

(Thomsonian name.)

Lobelia,
Glycyrrhiza,
Skunk Cabbage,
Sugar, of each, 1 oz. (troy).
Mix.

DERIVATIVES OF SUGARS THROUGH THE ACTION OF FERMENTS.

Alcoholic Mixture.

(Gubler's.)

Alcohol (85 per cent.),
Water,
Syrup of Orange, of each, 2 fl. oz.

A tablespoonful to be given every two hours.

Solution of Butyl-Chloral.

(Croton-Chloral.)

Butyl-Chloral,	7 gr.
Alcohol,	30 min,
Distilled Water,	2¼ fl. oz.
Syrup of Orange,	2 fl. oz.

Mix. A tablespoonful every two hours.

Camphorated Chloro-tannate of Iodine.

Chloral,	60 gr.
Iodine,	30 gr.
Oil of Camphor,	6 fl. dr.
Tannic Acid, sufficient.	

Dissolve, and add sufficient Tannic Acid to bring the mixture to the consistence of thick syrup.

Glycerole of Chloral and Camphor.

(C. Pavesi.)

Camphor (in powder),	75 gr.
Chloral,	60 gr.
Oil of Juniper,	30 min.
Glycerin,	4 fl. dr.
Alcohol,	5 fl. dr.

Mix in a vial, and expose to a gentle heat (not over 40° C. = 104° F.) until solution has been effected. Let cool, and keep the vial well stoppered.

17. Chloral Camphoratum. *N. F.*

Camphorated Chloral.

Chloral et Camphora. Chloral and Camphor.

Chloral,	50 parts.
Camphor,	50 parts.

Mix them by agitation in a bottle, or by trituration in a warm mortar, until they are liquefied and combined.

Chloral Cream.

Chloral,	300 gr.
Sugar,	1½ oz. (troy).
Water,	15 fl. dr.

Dissolve the Chloral in the Water, and triturate with the Sugar in a mortar.

Elixir of Chloroform.

Chloroform,	6 fl. dr.
Oil of Cinnamon,	10 min.
Tincture of Opium,	
Tincture of Camphor,	
Aromatic Spirit of Ammonia, of each,	6 fl. dr.
Brandy,	1 fl. oz.

Mix. Dose, half a teaspoonful.

5. Aqua Chloroformi. *N. F.*

Chloroform Water.

Purified Chloroform,	30 min.
Distilled Water,	10 fl. oz.

Shake them together in a capacious bottle, until the Chloroform is dissolved, or until only a small quantity remains which cannot be dissolved by further agitation. Then filter in a covered funnel. Keep the product in well-stoppered bottles.

Note.—Chloroform Water, aside from its medicinal properties, is an efficient preservative agent, and forms a good solvent, in place of water, for preparing solutions which require to be kept free from micro-organisms.

41. Elixir Chloroformi Compositum. *N. F.*

Compound Elixir of Chloroform.

Chloroform,	8 fl. oz.
Tincture of Opium,	8 fl. oz.
Spirit of Camphor,	8 fl. oz.
Aromatic Spirit of Ammonia,	8 fl. oz.
Alcohol,	8 fl. oz.
Oil of Cinnamon (Cassia),	40 min.
Water, enough to make	16 fl. oz.

Mix the Chloroform with the Alcohol, then add the Oil of Cinnamon, Aromatic Spirit of Ammonia, Spirit of Camphor, Tincture of Opium, and, lastly, enough Water to make *sixteen* (16) *fluidounces*. Allow the mixture to stand a few hours, and filter in a well-covered funnel.

Each fluidrachm represents about 1 *grain of Opium and* 11 *minims of Chloroform.*

Note.—This preparation is called Chloroform Paregoric in some sections of the country. It is recommended that this title be abandoned, to prevent confusion with the officinal Paregoric or *Tinctura Opii Camphorata.*

113. Emulsio Chloroformi. *N. F.*

Emulsion of Chloroform.

Chloroform,	40 min.
Tincture of Quillaja,	80 min.
Acacia, in fine powder,	12 gr.
Water, enough to make	2 fl. oz.

Put the Chloroform and the Tincture of Quillaja into a two-ounce vial, add the Powdered Acacia, shake, and afterwards add the Water. Shake the mixture before using.

Each fluidrachm contains 2½ *minims of Chloroform.*

253. Mistura Chloral et Potassii Bromidi Composita. *N. F.*

Compound Mixture of Chloral and Bromide of Potassium.

Chloral,	4 tr. oz.
Bromide of Potassium,	4 tr. oz.
Extract of Indian Cannabis,	16 gr.
Extract of Hyoscyamus,	16 gr.
Alcohol,	1 fl. oz.
Tincture of Quillaja (N. F.),	1 fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Chloral and Bromide of Potassium in *twelve* (12) *fluidounces* of Water, dissolve in this solution the Extract of Hyoscyamus, and add the Tincture of Quillaja. Then dissolve the Extract of Indian Cannabis in the Alcohol, and add this solution gradually to that first prepared, agitating it during the addition. Finally, add enough Water to make *sixteen* (16) *fluidounces.*

This preparation should be shaken whenever any of it is to be dispensed.

Each fluidrachm contains 15 *grains, each, of Chloral and of Bromide of Potassium, and* ⅛ *grain, each, of Extract of Indian Cannabis and of Extract of Hyoscyamus.*

Note.—The resinous Extract of Indian Cannabis is merely held in suspension by means of the Tincture of Quillaja, as it is practically insoluble in the liquid. If the mixture is filtered, the resin will remain on the filter.

254. Mistura Chloroformi et Opii. *N. F.*

Mixture of Chloroform and Opium.

Chloroform Anodyne.

Purified Chloroform,	2 fl. oz.
Oil of Peppermint,	16 min.
Tincture of Indian Cannabis,	2 fl. oz.
Tincture of Quillaja (N. F.),	2 fl. oz.
Fluid Extract of Belladonna,	128 min.
Deodorized Tincture of Opium,	2½ fl. oz.
Tincture of Capsicum,	1 fl. oz.
Purified Extract of Glycyrrhiza,	240 gr.
Water,	½ fl. oz.
Syrup, enough to make	16 fl. oz.

Triturate the Purified Extract of Glycyrrhiza with the Water and *one* (1) *fluidounce* of the Syrup until it is dissolved. Mix the Fluid Extract of Belladonna, Deodorized Tincture of Opium, and Tincture of Capsicum, and add them to the solution first prepared. Then mix the Chloroform, Oil of Peppermint, Tincture of Indian Cannabis, and Tincture of Quillaja, and add them to the mixture. Finally, add enough Syrup to make *sixteen* (16) *fluidounces* and mix the whole thoroughly together.

This mixture should be shaken whenever any of it is to be dispensed. See

pages 481 and 1507, 16th ed. U. S. Dispensatory.

Each fluidrachm represents 7½ minims of Chloroform, 7½ minims of Tincture of Indian Cannabis, 3¾ minims of Tincture of Capsicum, 1 minim of Fluid Extract of Belladonna, and about 1 grain of Opium.

Note.—This preparation is intended to fulfil the same purposes as the *Tinctura Chloroformi et Morphinæ* of the British Pharm., though the composition of the latter differs materially from that of the mixture above given.

Gelatinized Chloroform.

Purified Chloroform,	6 fl. dr.
White of Egg,	6 fl. dr.

Put into a wide-mouth two-ounce vial, shake it, and allow it to stand for three hours.

Elixir of Chloroform.

(Dr. Hartshorn's Chloroform Paregoric.)

Chloroform,	1¼ fl. oz.
Tincture of Opium,	1¼ fl. oz.
Spirit of Camphor,	1¼ fl. oz.
Aromatic Spirit of Ammonia,	1¼ fl. oz.
Oil of Cinnamon,	20 min.
Brandy,	2 fl. oz.

Mix. Dose, ½ fl. dr. or less.

315. Pulvis Iodoformi Dilutus. *N. F.*

Diluted Powder of Iodoform.

Iodoform and Naphthalin.

Iodoform, in fine powder,	2 tr. oz.
Boric Acid, in fine powder,	8 tr. oz.
Naphthalin,	5 tr. oz.
Oil of Bergamot,	120 min.

Triturate the Naphthalin with the Oil of Bergamot, then mix it with the Iodoform and Boric Acid, and triturate until a homogeneous powder is produced.

Note.—This powder is used in many cases where a *diluted* preparation of Iodoform, for external purposes, is desired. The odor of the Iodoform is masked both by the Oil of Bergamot and by the Naphthalin.

15. Carbasus Iodoformata. *N. F.*

Iodoform Gauze.

Iodoform,	10 parts.
Stronger Ether,	40 parts.
Alcohol,	40 parts.
Tincture of Benzoin,	5 parts.
Glycerin,	5 parts.
Gauze Muslin,	a sufficient quantity.

Dissolve the Iodoform in the Stronger Ether, then add the Alcohol, Tincture of Benzoin, and Glycerin. Immerse in a weighed quantity of this solution, contained in a suitable vessel, the exact amount of Gauze Muslin required to absorb the whole of it, to produce a product of a prescribed percentage of iodoform, work it about with a pestle so as to impregnate it uniformly; then take it out, and hang it up to dry, in a horizontal position, and in a dark place. Lastly, wrap it in paraffin paper and preserve it in air-tight receptacles.

Note.—To calculate the amount of muslin and of iodoform solution required to obtain a product approximately of any required percentage of iodoform, let x denote this required percentage. Then take of the above Iodoform Solution *ten* (10) *times* this quantity (or 10 x). Also multiply the required percentage (x) by *three* (3), divide the resulting product by *two* (2), and subtract the quotient from *one hundred* (100). The remainder represents the number of parts by weight of Gauze Muslin to be used. Regarding the most suitable kind of Gauze Muslin, see note to *Carbasus Carbolata* (page 1191).

192. Iodoformum Aromatisatum. *N. F.*

Aromatized Iodoform.

Deodorized Iodoform.

Iodoform,	25 parts.
Cumarin,	1 part.

Mix them intimately by trituration.

Note.—Should Cumarin not be available, or should it be objectionable to the patient, the odor of Iodoform may also be more or less masked by many essential oils, for instance, those of peppermint, cloves, cinnamon, citronella, bergamot, sassafras, eucalyptus, etc. Another efficient covering agent is freshly-roasted and powdered coffee.

The odor of Iodoform may be removed from the hands or any utensils which it has come in contact with, by washing them with an aqueous solution of tannic acid.

Wade's Suppositories.

Iodoform,	60 gr.
Subnitrate of Bismuth,	60 gr.
Chloral,	8 gr.
Morphine,	2½ gr.
Oil of Rose,	10 min.
Oil of Theobroma,	240 gr.

Mix, and divide into 12 suppositories one-eighth of an inch in diameter. One to be inserted into the urethra three times daily.

Carbolized Iodoform.

Iodoform,	150 gr.
Carbolic Acid,	1 min.
Oil of Peppermint,	2 min.

Mix the Iodoform and Acid by trituration, and then add the volatile oil.

Iodoform Paste.

Iodoform,	60 gr.
Mucilage of Acacia,	10 min.
Glycerin,	10 min.
Oil of Peppermint,	1 min.

Mix.

Iodoform Cotton.

Purified Cotton,	360 gr.
Iodoform,	24 gr.
Ether,	2 fl. dr.
Alcohol,	4 fl. dr.
Glycerin,	2 fl. dr.

Dissolve the Iodoform in the Ether and Alcohol mixed, add the Glycerin to this solution, and saturate the Cotton with this liquid. Let it dry by exposure to the air.

Iodoform Pencils.

Iodoform,
Oil of Theobroma, of each, 31 gr.
Triturate together, and roll the mass into 5 pencils, one-twelfth of an inch thick, then dust with lycopodium.

Compound Iodoform Ointment.

(Dr. J. Wm. White's.)

Iodoform,	60 gr.
Oil of Anise,	20 min.
Oil of Rose,	5 min.
Oil of Ylang-Ylang,	5 min.
Ointment of Rose Water,	1 oz. (troy).

Mix.

Compound Iodoform Ointment.

(N. Y. Hosp.)

Iodoform,
Tannic Acid, of each, 60 gr.
Vaseline, 1 oz. (troy).
Mix.

Compound Tincture of Iodoform.

Iodoform,	15 gr.
Potassium Iodide,	120 gr.
Glycerin,	2 fl. dr.
Alcohol,	6 fl. dr.

Mix. Rub the Iodoform and the Potassium Iodide in a mortar until a fine powder is produced, then add the Glycerin and rub to the consistency of cream; then add the Alcohol, and stir briskly until all is dissolved. Dose, 15 drops three times a day, on sugar or in syrup.

Liniment of Iodoform.

Iodoform,	80 gr.
Camphor,	80 gr.
Oil of Sassafras,	1 fl. dr.
Expressed Oil of Almond,	4 fl. oz.

Powder the Iodoform and Camphor, introduce into a dry vial, add the Oils, and heat in a water-bath, shaking frequently until dissolved.

Elixir of Paraldehyd.

Paraldehyd,	160 min.
Alcohol,	14 fl. dr.
Tincture of Vanilla,	80 min.
Water,	1 fl. oz.
Syrup,	1½ fl. oz.

Dose, 1 to 2 teaspoonfuls.

PRODUCTS OF THE ACTION OF FERMENTS UPON ACID SACCHARINE FRUITS.

Potion of Todd.

(Dorvault's.)

Brandy,	6 fl. dr.
Distilled Water,	9 fl. dr.
Syrup,	4 fl. dr.
Tincture of Canella,	1 fl. dr.

Mix.

Brandy Mixture.

Yolk of Eggs,	2.
Sugar,	240 gr.
Oil of Cinnamon,	2 min.
Cinnamon Water,	4 fl. oz.
Brandy,	4 fl. oz.

Mix. Dose, a tablespoonful as occasion may require.

Strengthening Syrup.

(Thomsonian name.)

Comfrey Root,	2 oz. (av.).
Inula,	1 oz. (av.).
Marrubium,	240 gr.
Beth Root,	120 gr.
Brandy,	8 fl. oz.
Sugar,	8 oz. (av.).
Water,	3 pints.

Add the Water to the Comfrey Root, Inula, and Marrubium, and boil until the liquid measures 24 fl. oz., then strain, and add the remaining ingredients.

VOLATILE OILS.

Confectio Aurantii Corticis. *U. S.* **1870.**

CONFECTION OF ORANGE PEEL.

Sweet Orange Peel, recently separated from the fruit by grating, 6 oz. (troy).
Sugar, 18 oz. (troy).
Beat the Orange Peel with the Sugar, gradually added, until they are thoroughly mixed.

Cardinal Drops, or Bishop Drops.

(TINCTURA EPISCOPALIS.)

Orange Peel,	720 gr.
Orange Berries,	720 gr.
Cloves,	120 gr.
Cinnamon,	120 gr.
Water,	8 fl. oz.
Bitter Almond Water,	2 fl. dr.
Alcohol,	12 fl. oz.

Mix, and macerate seven days.

342. Spiritus Olei Volatilis. *N. F.*

Spirit of a Volatile Oil.

Any Spirit or alcoholic solution of a Volatile Oil, for which no formula is given by the U. S. Pharm. or by this *Formulary*, should be prepared in accordance with the following general formula:

Any Volatile Oil, 400 min.
Deodorized Alcohol, enough to make 16 fl. oz.
Dissolve the Volatile Oil in the Deodorized Alcohol.

Note.—The strength of the Spirit thus prepared is approximately 5 per cent. by weight, provided the specific gravity of the Oil is about 0·900.

337. Spiritus Aromaticus. *N. F.*

Aromatic Spirit.

Compound Spirit of Orange (N. F.),	8 fl. oz.
Deodorized Alcohol,	7½ pints.

Mix them. Preserve the product, if it is to be kept in stock, in completely-filled and well-stoppered vials or bottles, and stored in a cool and dark place.

Aromatic Spirit may also be prepared in the following manner:

Sweet Orange Peel, fresh, and deprived of the white, inner portion,	16 tr. oz.
Lemon Peel, fresh,	2 tr. oz.
Coriander, bruised,	2 tr. oz.
Oil of Star Anise,	16 min.
Deodorized Alcohol, enough to make	1 gal.

Macerate the solids during four days with 1 gallon of Deodorized Alcohol; then add the Oil of Star Anise, filter, and pass enough Deodorized Alcohol through the filter to make the product measure *one* (1) *gallon*.

Note.—When good, fresh essential oils cannot be readily obtained for preparing the Compound Spirit of Orange, the second formula may be used. But the product obtained by it should not be employed in mixtures containing *iron*, as the latter would cause a darkening of the mixture.

338. Spiritus Aurantii Compositus. *N. F.*

Compound Spirit of Orange.

Oil of Bitter Orange Peel,	4 fl. oz.
Oil of Lemon,	1 fl. oz.
Oil of Coriander,	160 min.
Oil of Star Anise,	40 min.
Deodorized Alcohol, enough to make	20 fl. oz.

Mix them.

Note.—One fluidounce of this Spirit and 15 fluidounces of Deodorized Alcohol make 1 pint of Aromatic Spirit. (See No. 337.)

The essential oils used in this preparation, particularly those of orange and lemon, must be as fresh as possible, and *absolutely free* from any terebinthinate odor or taste. They should be diluted as soon as received, with a definite quantity of Deodorized Alcohol, which will retard deterioration. They should not be kept in stock, undiluted, for any length of time, or should at least be kept in bottles completely filled, and in a dark place. The alcoholic solution should be kept in the same manner. If Oil of Curaçao Orange of good quality can be obtained, it is advisable to use this, in place of ordinary oil of orange, as it imparts to the Spirit a finer flavor than the latter.

340. Spiritus Curassao. *N. F.*

Spirit of Curaçao.

Oil of Curaçao Orange,	2 fl. oz.
Oil of Fennel,	15 min.
Oil of Bitter Almond,	8 min.
Deodorized Alcohol,	10 fl. oz.

Mix the Oils with the Deodorized Alcohol, and keep the Spirit in completely-filled and well-corked bottles, and stored in a cool and dark place.

Note.—The essential oils used in this case must be as fresh as possible, and *absolutely free* from any terebinthinate odor or taste. Oil of Curaçao Orange may be obtained without difficulty in the market, but it should be carefully examined as to its quality, immediately upon receipt, and should not be kept in stock for any length of time, without special precautions (see *Note* to No. 338). A still finer quality of Oil of Orange is that derived from *Citrus nobilis*, which is known in the market as Oil of Mandarin.

53. Elixir Curassao. *N. F.*

Elixir of Curaçao.

Curaçao Cordial.

Spirit of Curaçao,	120 min.
Orris Root, in fine powder,	80 gr.
Deodorized Alcohol,	4 fl. oz.
Citric Acid,	50 gr.
Syrup,	8 fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Mix the Spirit of Curaçao with the Alcohol, add the Orris Root, the Purified Talcum, and *three* (3) *fluidounces* of Water. Allow the mixture to stand twelve hours, occasionally agitating; then pour it on a wetted filter, returning the first portions of the filtrate until it runs through clear, and pass enough Water through the filter to make the filtrate measure *eight* (8) *fluidounces*. In this dissolve the Citric Acid, and finally add the Syrup.

274. Oleosacchara. *N. F.*

Oil-Sugars.

Elæosacchara (*Germ. Pharm.*).

Any Volatile Oil,	1 drop.
Sugar,	30 gr.

Triturate the Sugar with the Volatile Oil to a fine powder.

This preparation should be freshly made when wanted for use.

Note.—When *Elæosaccharum Anisi*, *E. Fœniculi*, *E. Menthæ Piperitæ*, etc., are prescribed, these are to be prepared from the corresponding essential oils, according to the above formula.

352. Syrupus Asari Compositus. *N. F.*

Compound Syrup of Asarum.

Compound Syrup of Canada Snake-Root.

Asarum Root, in moderately coarse (No. 40) powder,	448 gr.
Alcohol,	3 fl. oz.
Cochineal, in fine powder,	10 gr.
Carbonate of Potassium,	20 gr.
Wine of Ipecac,	220 min.
Sugar,	11 tr. oz.
Water, enough to make	16 fl. oz.

Mix the Asarum intimately with the Cochineal and Carbonate of Potassium, previously triturated together. Moisten

the powder with a sufficient quantity of a menstruum prepared by mixing the Alcohol with *six* (6) *fluidounces* of Water, and allow it to macerate, in a covered vessel, for twenty-four hours, then transfer it to a small percolator, and pour on the remainder of the menstruum. Allow the percolation to proceed slowly, and then follow up the menstruum by Water, until *eight* (8) *fluidounces* of percolate are obtained. To this add the Wine of Ipecac, and afterwards the Sugar, and dissolve the latter by agitation. Finally, add enough Water, previously passed through the percolator, to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about 3½ grains of Asarum.

391. Tinctura Aromatica. *N. F.*

Aromatic Tincture.

Cinnamon (Cassia),	650 gr.
Ginger,	260 gr.
Galangal (root),	130 gr.
Cloves,	130 gr.
Cardamom,	130 gr.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Reduce the drugs to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with a mixture of *two* (2) *volumes* of Alcohol and *one* (1) *volume* of Water, until *sixteen* (16) *fluidounces* of percolate are obtained.

Note.—This preparation is practically identical with that which is officinal in the Germ. Pharm. Galangal is the root of *Alpinia officinarum* Hance.

343. Spiritus Ophthalmicus. *N. F.*

Ophthalmic Spirit.

Alcoholic Eye-Wash.

Oil of Lavender,	10 min.
Oil of Rosemary,	30 min.
Alcohol,	1 fl. oz.

Mix them by agitation, and, if necessary, filter the liquid through paper.

336. Spiritus Amygdalæ Amaræ. *N. F.*

Spirit of Bitter Almond.

Essence of Bitter Almond.

Oil of Bitter Almond,	160 min.
Alcohol,	14 fl. oz.
Distilled Water, enough to make	16 fl. oz.

Dissolve the Oil in the Alcohol, and add enough Distilled Water to make *sixteen* (16) *fluidounces*.

346. Spiritus Sinapis. *N. F.*

Spirit of Mustard.

Volatile Oil of Mustard,	190 min.
Alcohol, enough to make	16 fl. oz.

Mix them.

Note.—This preparation is officinal in the Germ. Pharm.

417. Tinctura Vanillini Composita. *N. F.*

Compound Tincture of Vanillin.

Compound Essence of Vanillin.

Vanillin,	45 gr.
Cumarin,	3 gr.
Alcohol,	3 fl. oz.
Glycerin,	2 fl. oz.
Syrup,	2 fl. oz.
Compound Tincture of Cudbear (N. F.),	120 min.
Water, enough to make	16 fl. oz.

Dissolve the Vanillin and Cumarin in the Alcohol, add the Glycerin, Syrup, and Compound Tincture of Cudbear, and, lastly, enough Water to make *sixteen* (16) *fluidounces*.

72. Elixir Grindeliæ. *N. F.*

Elixir of Grindelia.

Fluid Extract of Grindelia,	1 fl. oz.
Aromatic Spirit,	2 fl. oz.
Compound Elixir of Taraxacum,	13 fl. oz.

Mix them, allow the mixture to stand a few days, if convenient, then filter.

Each fluidounce represents 30 grains of Grindelia.

Red Elixir.

Compound Tincture of Cochineal,	6 fl. dr.
Elixir of Orange,	24 fl. oz.

Mix.

Red Drops.

(Whitwith's.)

Oil of Thyme,	2 fl. dr.
Tincture of Myrrh,	1 fl. oz.
Tincture of Camphor,	1 fl. dr.
Compound Tincture of Lavender,	1 fl. oz.
Alcohol,	4 fl. oz.

Dose, 25 drops in a suitable vehicle, two, three, or four times a day.

Confectio Aromatica. *U. S.* 1870. Aromatic Confection.

Aromatic Powder,	4 oz. (troy).
Clarified Honey,	4 oz. (troy).

Rub the Aromatic Powder with Clarified Honey until a uniform mass of the proper consistence is obtained.

Eucalyptus Gauze.

(Lister's.)

Oil of Eucalyptus,	60 min.
Damar,	180 gr.
Paraffin,	180 gr.

The Damar and Paraffin are melted, the Oil is added, and the mixture sprinkled or squirted over the muslin laid together in folds. It is then placed in an air-tight heating apparatus, compressed by weights, and exposed to a dry heat. The finished gauze contains 10 to 11 per cent. of mixture.

Compound Spirit of Cajuput.

Oil of Cajuput,		
Oil of Cloves,		
Oil of Peppermint,		
Oil of Anise,	of each,	4 fl. dr.
Alcohol,		2 fl. oz.

Mix. A powerful stimulant.

Compound Mixture of Apium.

(Dr. W. A. Hammond's.)

Fluid Extract of Erythroxylon,	2 fl. oz.
Fluid Extract of Viburnum,	1 fl. oz.
Fluid Extract of Celery,	1 fl. oz.

Mix.

Elemi Ointment.

Elemi (Resin),	60 gr.
Cerate,	1 oz. (troy).
Resin Cerate,	120 gr.
Balsam of Peru,	120 min.

Fuse together, and mix thoroughly.

Croup Liniment.

Camphor,	320 gr.
Oil of Turpentine,	2 fl. oz.

Make a solution.

Carbolated Camphor.

Camphor,	60 gr.
Carbolic Acid,	20 gr.
Alcohol,	2 min.

Mix.

Brassicon.

Camphor,	20 gr.
Oil of Peppermint,	1 fl. dr.
Volatile Oil of Mustard,	12 min.
Ether,	2 fl. dr.
Alcohol,	6 fl. dr.
Spirit of Peppermint, sufficient to color.	

Mix. Used externally in headache.

Cholera Remedy.

(Dr. Dwight's.)

Tincture of Camphor,	1 fl. oz.
Tincture of Opium,	1 fl. oz.
Compound Tincture of Rhubarb,	1 fl. oz.

Mix. Dose, half a teaspoonful.

25. Elixir Adjuvans. *N. F.*

Adjuvant Elixir.

Sweet Orange Peel, recently dried,	2 tr. oz.
Wild Cherry,	4 tr. oz.
Glycyrrhiza, Russian, peeled,	8 tr. oz.
Coriander,	1 tr. oz.
Caraway,	1 tr. oz.
Alcohol,	
Water, each, a sufficient quantity.	
Syrup, enough to make	1 gal.

Grind the Wild Cherry to a moderately coarse (No. 40) powder, moisten it with *four* (4) *fluidounces* of Water and set it aside for twelve hours. Reduce the other solids also to a moderately coarse (No. 40) powder, mix this intimately with the Wild Cherry, and having mixed *one* (1) *volume* of Alcohol with *two* (2) *volumes* of Water, moisten the powder with *four* (4) *fluidounces* of the mixture, and pack tightly in a percolator. Then gradually pour menstruum on top until *ninety-six* (96) *fluidounces* of percolate are obtained. Mix this with *thirty-two* (32) *fluidounces* of Syrup, and filter.

Note.—This preparation is chiefly intended as a vehicle, particularly for acrid or saline remedies.

29. Elixir Anisi. *N. F.*

Elixir of Anise.

Aniseed Cordial.

Anethol,	25 min.
Oil of Fennel,	5 min.
Oil of Bitter Almond,	1 drop.
Deodorized Alcohol,	4 fl. oz.
Syrup,	10 fl. oz.
Water,	2 fl. oz.
Purified Talcum,	120 gr.

Mix the Anethol and the Oils with the Deodorized Alcohol, add the Syrup and Water, and set the mixture aside for twelve hours. Then mix it intimately with the Purified Talcum, and filter it through a wetted filter, returning the first portions of the filtrate until it runs through clear.

Note.—This Elixir is liable to become cloudy from separation of essential oils, when it is exposed to a temperature lower than that at which it has been filtered. In general, it is recommended that it be cooled to, and filtered at, a temperature of about 15° C. (59° F.). In the northern sections of this country, or in winter time, it should be cooled to a proportionately lower temperature, previous to filtration.

Anethol is the stearopten of oil of anise, and possesses a finer and purer aroma and taste than any commercial variety of oil of anise. If it cannot be readily obtained, the so-called Saxon oil of anise may be substituted for it. Oil of star-anise, which is usually supplied by dealers when "oil of anise" without specification is ordered, does not answer well for this purpose. The oil of fennel should be that from the seed ("sweet"), and not that from the chaff.

31. Elixir Aromaticum. *N. F.*

Aromatic Elixir.

Aromatic Spirit,	16 fl. oz.
Syrup,	24 fl. oz.
Water,	24 fl. oz.
Purified Talcum,	1 tr. oz.

Mix the Aromatic Spirit with *twelve* (12) *fluidounces* of Syrup, and add the Water. Incorporate the Purified Talcum thoroughly with the mixture, set the latter aside during a few days, if possible, occasionally agitating, then stir it well, and filter it through a wetted filter, returning the first portions of the filtrate until it runs through clear. Finally,

mix the filtrate with the remainder of the Syrup.

Note.—When this Elixir is to be used in preparations containing *iron*, the Aromatic Spirit to be used in this preparation should be that made from the essential oils. See *Spiritus Aromaticus.* If it is desired to color this Elixir, this may be effected by the addition of *two* (2) *fluidrachms* of Compound Tincture of Cudbear to each pint.

30. Elixir Apii Graveolentis Compositum. *N. F.*

Compound Elixir of Celery.

Fluid Extract of Celery Root,	1 fl. oz.
Fluid Extract of Erythroxylon,	1 fl. oz.
Fluid Extract of Kola,	1 fl. oz.
Fluid Extract of Viburnum Prunifolium,	1 fl. oz.
Alcohol,	2 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Alcohol with *four* (4) *fluidounces* of Aromatic Elixir. To this add the Fluid Extract of Celery Root in several portions, shaking after each addition, and afterwards the other Fluid Extracts. Finally, add enough Aromatic Elixir to make *sixteen* (16) *fluidounces;* allow the mixture to stand twenty-four hours, and filter.

Note.—If this preparation is prescribed or quoted under its Latin title, it is recommended that the full title be given, so that the word "Apii" may not be mistaken for "Opii."

57. Elixir Eucalypti. *N. F.*

Elixir of Eucalyptus.

Fluid Extract of Eucalyptus,	2 fl. oz.
Alcohol,	2 fl. oz.
Carbonate of Magnesium,	120 gr.
Syrup of Coffee,	6 fl. oz.
Compound Elixir of Taraxacum,	6 fl. oz.

Mix the Fluid Extract with the Alcohol, then add the other ingredients, shake the mixture occasionally during forty-eight hours, and filter.

Each fluidrachm represents 7½ grains of Eucalyptus.

110. Emplastrum Aromaticum. *N. F.*

Aromatic Plaster.

Spice Plaster.

Cloves,	10 parts.
Cinnamon, Saigon,	10 parts.
Ginger,	10 parts.
Capsicum,	5 parts.
Camphor,	5 parts.
Cotton-Seed Oil,	35 parts.
Lead Plaster,	25 parts.

Melt together the Lead Plaster and Cotton-Seed Oil, with the aid of heat. Cool the mixture and, while it is still soft, thoroughly incorporate with it the aromatic ingredients, previously reduced to a very fine powder.

199. Linimentum Terebinthinæ Aceticum. *N. F.*

Acetic Turpentine Liniment.

Linimentum Album. Stokes's Liniment. St. John Long's Liniment.

Oil of Turpentine,	3 fl. oz.
Fresh Egg, albumen and yolk,	1
Oil of Lemon,	60 min.
Acetic Acid (U. S. P.),	300 min.
Rose Water,	2½ fl. oz.

Triturate or beat the contents of the Fresh Egg with the Oil of Turpentine and the Oil of Lemon in a mortar until they are thoroughly mixed. Then incorporate the Acetic Acid and Rose Water. Shake the mixture whenever any of it is to be dispensed.

425. Vinum Aurantii Compositum. *N. F.*

Compound Wine of Orange.

Elixir Aurantiorum Compositum (*Germ. Pharm.*). Compound Elixir of Orange.

Bitter Orange Peel,	1600 gr.
Absinthium,	480 gr.
Menyanthes (leaves),	480 gr.
Cascarilla,	480 gr.
Cinnamon (Cassia),	320 gr.
Gentian,	320 gr.
Carbonate of Potassium,	80 gr.
Sherry Wine, enough to make	16 fl. oz.

Reduce the six first-named drugs to a moderately coarse (No. 40) powder, mix with this the Carbonate of Potassium, moisten the mixture with Sherry Wine, and let it macerate during twenty-four hours. Then pack it in a percolator, and percolate with Sherry Wine, in the usual manner, until *sixteen* (16) *fluidounces* of product are obtained.

Note.—The Germ. Pharm. directs to macerate the Orange Peel, Cinnamon, and Carbonate of Potassium with the Sherry Wine, and then to add the other drugs in form of extracts. The proportions above given produce a product practically identical with that of the Germ. Pharm.

339. Spiritus Cardamomi Compositus. *N. F.*

Compound Spirit of Cardamom.

Oil of Cardamom,*	12 min.
Oil of Caraway,	4 min.
Oil of Cinnamon, Cassia,	2 min.
Alcohol,	8 fl. oz.
Glycerin,	1 fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Oils in the Alcohol, add the Glycerin, and, lastly, enough Water to make *sixteen* (16) *fluidounces.*

Note.—This preparation is intended as a flavoring ingredient, being equivalent to the officinal *Tinctura Cardamomi Composita,* without the coloring matter.

* The oil of cardamom may be replaced by 180 grains of freshly-bruised cardamom, and macerating for two days in the alcoholic solution of the oils.

361. Syrupus Eriodictyi Aromaticus. N. F.

Aromatic Syrup of Eriodictyon.

Aromatic Syrup of Yerba Santa. Syrupus Corrigens.

Fluid Extract of Eriodictyon,	½ fl. oz.
Solution of Potassa,	180 min.
Compound Tincture of Cardamom,	1 fl. oz.
Oil of Sassafras,	4 drops.
Oil of Lemon,	4 drops.
Oil of Cloves,	8 drops.
Alcohol,	½ fl. oz.
Sugar,	18 tr. oz.
Water, enough to make	16 fl. oz.

Mix the Fluid Extract of Eriodictyon and Solution of Potassa, then add *one and one-half* (1½) *fluidounces* of Water previously mixed with the Compound Tincture of Cardamom, and afterwards add the Oils dissolved in the Alcohol. Shake the mixture thoroughly, then filter it, and pour enough Water through the filter to obtain *six* (6) *fluidounces* of filtrate. Pour this upon the Sugar contained in a bottle, and dissolve it by placing the bottle in hot water, frequently agitating. Lastly, cool the product and add enough Water, passed through the filter previously used, to make *sixteen* (16) *fluidounces.*

Note.—This preparation is chiefly intended as a vehicle for disguising the taste of quinine or of other bitter substances.

424. Vinum Aurantii. N. F.

Wine of Orange.

Oil of Bitter Orange,	6 min.
Alcohol,	60 min.
Purified Talcum,	120 gr.
Sherry Wine, enough to make	16 fl. oz.

Triturate the Purified Talcum, first with the Alcohol, in which the Oil of Bitter Orange had previously been dissolved, and afterwards with *twelve* (12) *fluidounces* of Sherry Wine, gradually added. Filter the mixture through a wetted filter, returning the first portions of the filtrate until it runs through clear, and, lastly, pass enough Sherry Wine through the filter to make *sixteen* (16) *fluidounces.*

360. Syrupus Cinnamomi. N. F.

Syrup of Cinnamon.

Cinnamon (Cassia), in moderately coarse powder,	1½ tr. oz.
Alcohol,	360 min.
Sugar,	11 tr. oz.
Cinnamon Water, enough to make	16 fl. oz.

Mix the Alcohol with *seven* (7) *fluidounces* of Cinnamon Water, moisten the Cinnamon with a sufficient quantity of this menstruum and allow it to macerate for about two hours. Then transfer it to a small percolator and percolate in the usual manner, using first the remainder of the menstruum above directed and afterwards Cinnamon Water. Collect the first *eight* (8) *fluidounces* of the percolate separately and dissolve in it the Sugar. Then collect an additional quantity of percolate and add it to the Syrup, so as to make *sixteen* (16) *fluidounces.*

Note.—This preparation is practically identical with that officinal in the Germ. Pharm.

262. Mistura Sassafras et Opii. N. F.

Mixture of Sassafras and Opium.

Mistura Opii Alkalina. Godfrey's Cordial.

Oil of Sassafras,	6 min.
Tincture of Opium,	256 min.
Alcohol,	360 min.
Carbonate of Potassium,	60 gr.
Molasses,	5 fl. oz.
Water, enough to make	16 fl. oz.

Mix the Tincture of Opium with the Alcohol, in which the Oil of Sassafras had previously been dissolved. Dissolve the Carbonate of Potassium in about *eight* (8) *fluidounces* of Water, mix this with the Molasses, then add the mixture first prepared, and, lastly, enough Water to make *sixteen* (16) *fluidounces.* Allow the mixture to become clear by standing, then pour off the liquid portion and preserve it for use.

Each fluidrachm contains 2 minims of Tincture of Opium, corresponding to about ⅙ grain of Opium.

251. Mistura Camphoræ Aromatica. N. F.

Aromatic Camphor Mixture.

Parrish's Camphor Mixture.

Compound Tincture of Lavender,	4 fl. oz.
Sugar,	½ tr. oz.
Camphor Water, enough to make	16 fl. oz.

Mix the Compound Tincture of Lavender with about *eight* (8) *fluidounces* of Camphor Water, dissolve the Sugar in the mixture, and add enough Water to make *sixteen* (16) *fluidounces.*

250. Mistura Camphoræ Acida. N. F.

Acid Camphor Mixture.

Mistura Antidysenterica. Hope's Mixture.

Nitric Acid,	120 min.
Tincture of Opium,	80 min.
Camphor Water, enough to make	16 fl. oz.

Mix the Nitric Acid with about *eight* (8) *fluidounces* of Camphor Water, add the Tincture of Opium, and, lastly, enough Camphor Water to make *sixteen* (16) *fluidounces.*

242. Liquor Zingiberis. *N. F.*

Solution of Ginger.

Soluble Essence of Ginger.

Fluid Extract of Ginger,	4 fl. oz.
Pumice, in moderately fine powder,	1 tr. oz.
Water, enough to make	12 fl. oz.

Pour the Fluid Extract of Ginger into a bottle, add to it the Pumice, and shake the mixture thoroughly and repeatedly in the course of several hours. Then add the Water in portions of about *two* (2) *fluidounces*, shaking well and frequently after each addition. When all is added, repeat the agitation occasionally during twenty-four hours, then filter, returning the first portions of the filtrate until it runs through clear, and, if necessary, pass enough Water through the filter to make *twelve* (12) *fluidounces.*

Camphor Julep.

(Thomsonian name.)

Camphor,	30 gr.
Myrrh,	105 gr.
Sugar,	60 gr.
Water,	2 fl. oz.

Cream of Camphor.

Soap,	1½ oz. (troy).
Camphor,	360 gr.
Ammonium Chloride,	1½ oz. (troy).
Water of Ammonia,	1½ fl. oz.
Oil of Turpentine,	6 fl. dr.
Water,	12 fl. oz.

Dissolve the Soap (in shavings) in one-half of the Water previously mixed with the Water of Ammonia, and the Ammonium Chloride in the other half. Mix the solutions well, and add the Camphor dissolved in the Oil; then agitate briskly until the liquids are united and form a perfect emulsion.

16. Ceratum Camphoræ Compositum. *N. F.*

Compound Camphor Cerate.

Ceratum Camphoratum. Camphor Ice.

Camphor, in coarse powder,	1¼ tr. oz.
White Wax,	2 tr. oz.
Castor Oil,	4 tr. oz.
Spermaceti,	7 tr. oz.
Carbolic Acid, liquefied by warming,	10 min.
Oil of Bitter Almond,	6 min.
Benzoic Acid,	60 gr.

Melt the White Wax and Spermaceti on a water-bath, add the Castor Oil, and afterwards the Camphor, and continue heating and stirring until the Camphor is dissolved. Then withdraw the heat, cover the vessel, and when the mixture has somewhat cooled, add the remaining ingredients, and thoroughly incorporate them by stirring. Lastly, pour the Cerate into suitable moulds.

420. Unguentum Camphoræ. *N. F.*

Camphor Ointment.

Unguentum Camphoratum.

Camphor, in coarse powder,	2 parts.
White Wax,	1 part.
Lard,	6 parts.

Melt the White Wax and Lard with a gentle heat, then add the Camphor, and stir the Ointment until it is cold.

Pills of Camphor and Opium.

Camphor,	48 gr.
Powdered Opium,	12 gr.
Alcohol,	12 min
Confection of Rose, sufficient.	

Make a mass and divide into 24 pills. Dose, 1 to 2 pills.

Compound Powder of Camphor.

(Gallop's Powder.)

Camphor,	
Powdered Acacia,	
Sugar,	of each, 1 oz.

Mix.

421. Unguentum Fuscum. *N. F.*

Brown Ointment.

Unguentum Matris. Mother's Salve.

Camphorated Brown Plaster (N. F.),	2 parts.
Olive Oil,	1 part.
Suet,	1 part.

Melt them together, and stir the mass until it is cold.

Mixture of Thymol.

(L. Lewin.)

Thymol,	1½ gr.
Orange Flower Water,	1½ fl. oz.
Distilled Water,	8½ fl. oz.

Mix. Dose, a tablespoonful several times a day.

Thymol Inhalation.

(Warren.)

Thymol,	8 gr.
Sodium Borate,	300 gr.
Glycerin,	10 fl. dr.
Camphor Water,	2½ fl. oz.
Tar Water,	7 fl. oz.

Mix. To be used as an inhalation by means of an atomizer.

Antiseptic Solution.

(Volkman's.)

Thymol,	30 gr.
Alcohol,	5 fl. dr.
Glycerin,	10 fl. dr.
Water,	6 fl. oz.

Mix.

Cough Mixture.

(Prof. Pancoast.)

Wild Cherry Bark,	240 gr.
Senega,	240 gr.
Ipecac,	120 gr.
Extract of Conium,	15 gr.
Compound Tincture of Cardamom,	1 fl. oz.
Compound Spirit of Juniper,	1 fl. oz.
Water, sufficient to make	10 fl. oz.

Percolate the solid ingredients with sufficient Water to make 8 fl. oz., then add the other ingredients. Two teaspoonfuls in water constitute the usual dose to relieve cough.

Antispasmodic Powders.

(Dr. Otto's.)

Ground Black Mustard,	240 gr.
Powdered Salvia,	240 gr.
Powdered Ginger,	240 gr.

Mix. Dose, in epilepsy, three teaspoonfuls for three mornings in succession; discontinue three mornings, and then give as before. To be mixed in water or molasses.

Garlic Ointment.

Fresh Garlic,	6 bulbs.
Lard,	2 oz. (troy).

Digest at a moderate heat for an hour, and strain.

VOLATILE OILS WITH RESIN PRODUCTS.

Confection of Black Pepper.

(Ward's Paste.)

Black Pepper,	2 oz. (troy).
Powdered Inula,	2 oz. (troy).
Powdered Fennel,	6 oz. (troy).
Honey,	4 fl. oz.
Sugar,	4 oz. (troy).

Rub the dry ingredients together into a very fine powder, and keep them in a covered vessel; but, whenever the confection is to be used, add the powder gradually to the Honey, and beat them until thoroughly incorporated. Dose, 60 to 120 grains three times a day.

Emulsion of Cubeb.

Oleoresin of Cubeb,	120 drops.
Yolk of Egg,	1.
Sugar,	120 gr.
Peppermint Water,	8 fl. oz.

Triturate the Oleoresin with the Sugar and Yolk of Egg, and then dilute with Peppermint Water. Dose, a teaspoonful four times a day.

Ethereal Tincture of Cubeb.

Cubeb,	2 oz. (troy).
Spirit of Nitrous Ether,	16 fl. oz.

Macerate for eight days, and filter.

33. Elixir Buchu. ***N. F.***

Elixir of Buchu.

Fluid Extract of Buchu,	2 fl. oz.
Alcohol,	1 fl. oz.
Syrup,	1 fl. oz.
Purified Talcum,	120 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Mix the Fluid Extract of Buchu with the Alcohol, then add *twelve* (12) *fluidounces* of Adjuvant Elixir, and the Syrup. Incorporate with it the Purified Talcum, and filter. Finally, pass enough Adjuvant Elixir through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents about 7½ *grains of Buchu.*

34. Elixir Buchu Compositum. ***N. F.***

Compound Elixir of Buchu.

Compound Fluid Extract of Buchu,	4 fl. oz.
Alcohol,	1 fl. oz.
Syrup,	1 fl. oz.
Purified Talcum,	120 gr.
Adjuvant Elixir, enough to make	16 fl. oz.

Mix the Compound Fluid Extract of Buchu with the Alcohol, then add *eight* (8) *fluidounces* of Adjuvant Elixir, and the Syrup. Incorporate with it the Purified Talcum, and filter. Finally, pass enough Adjuvant Elixir through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 15 *minims of Compound Fluid Extract of Buchu.*

Note.—It is advisable to allow the mixture of liquids with the Purified Talcum to remain at rest for several days before filtering.

35. Elixir Buchu et Potassii Acetatis. ***N. F.***

Elixir of Buchu and Acetate of Potassium.

Acetate of Potassium,	640 gr.
Elixir of Buchu, enough to make	16 fl. oz.

Dissolve the Acetate of Potassium in about *twelve* (12) *fluidounces* of Elixir of Buchu, filter, if necessary, and add enough Elixir of Buchu to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 5 *grains of Acetate of Potassium and about* 7 *grains of Buchu.*

74. Elixir Humuli. ***N. F.***

Elixir of Humulus.

Elixir of Hops.

Fluid Extract of Hops (N. F.),	2 fl. oz.
Carbonate of Magnesium,	120 gr.
Tincture of Vanilla,	240 min.
Compound Elixir of Taraxacum,	2 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Fluid Extract of Hops with the Carbonate of Magnesium, then gradually add the Compound Elixir of Taraxacum, Tincture of Vanilla, and enough Aromatic Elixir to make *sixteen* (16) *fluidounces.* Allow the mixture to stand several days, if convenient, occasionally agitating; then filter.

Each fluidrachm represents 7½ *grains of Humulus* (*Hops*).

107. Elixir Viburni Opuli Compositum. *N. F.*

Compound Elixir of Viburnum Opulus.

Compound Elixir of Crampbark.

Fluid Extract of Viburnum Opulus,	1¼ fl. oz.
Fluid Extract of Trillium,	2½ fl. oz.
Fluid Extract of Aletris,	1¼ fl. oz.
Compound Elixir of Taraxacum,	11 fl. oz.

Mix them, allow the mixture to stand a few days, and filter.

108. Elixir Viburni Prunifolii. *N. F.*

Elixir of Viburnum Prunifolium.

Elixir of Black Haw.

Fluid Extract of Viburnum Prunifolium,	2 fl. oz.
Compound Tincture of Cardamom,	1 fl. oz.
Aromatic Elixir,	13 fl. oz.

Mix them, allow the mixture to stand a few days, and filter.

Each fluidrachm represents about 7½ *grains of Viburnum Prunifolium.*

Syrup of Cubeb.

(Mitchell's.)

Fluid Extract of Cubeb,	2 fl. oz.
Magnesium Carbonate,	240 gr.
Sugar,	12 oz. (troy).
Oil of Bitter Almond,	1 min.
Orange Flower Water,	2 fl. oz.
Water, a sufficient quantity to make	16 fl. oz.

Rub the Fluid Extract with the Magnesium Carbonate, and then add 2 fl. oz. of the Sugar in small portions; when thoroughly mixed, add gradually first the Orange Flower Water and then 7 fl. oz. of Water, constantly triturating the mixture until the Sugar is dissolved; filter, and add sufficient Water to measure 11 fl. oz., in which dissolve the remainder of the Sugar, without heat; add the Oil dissolved in a little Alcohol, and sufficient Water to make 16 fl. oz.

Compound Pills of Copaiba.

Copaiba,	30 gr.
Powdered Cubeb,	60 gr.
Wax,	15 gr.

Melt the Wax by a gentle heat, then add the Copaiba, and immediately afterwards sift in the Cubeb, stirring thoroughly; while it is yet warm, roll out into 25 pills.

Cubeb Mixture.

(Dr. J. Wm. White's.)

Oleoresin of Cubeb,	4 fl. dr.
Potassium Bromide,	1 oz. (troy).
Syrup of Acacia,	2 fl. oz.
Oil of Sassafras,	10 min.
Water, sufficient to make	6 fl. oz.

Mix.

Copaiba Mixture.

(Chapman's original formula.)

Copaiba,	1 fl. oz.
Powdered Acacia,	120 gr.
Sugar,	60 gr.
Spirit of Nitrous Ether,	1 fl. oz.
Compound Tincture of Lavender,	2 fl. dr.
Tincture of Opium,	2 fl. dr.
Distilled Water,	6 fl. oz.

Mix. Dose, a tablespoonful three times a day.

256. Mistura Copaibæ Composita. *N. F.*

Compound Copaiba Mixture.

1. *Lafayette Mixture.*

Copaiba,	2 fl. oz.
Spirit of Nitrous Ether,	2 fl. oz.
Compound Tincture of Lavender,	2 fl. oz.
Solution of Potassa,	¼ fl. oz.
Syrup,	5 fl. oz.
Mucilage of Dextrin (N. F.), enough to make	16 fl. oz.

Mix the Copaiba with the Solution of Potassa and the Spirit of Nitrous Ether. Then add the Compound Tincture of Lavender, and, lastly, the Syrup and Mucilage of Dextrin. Mix the whole thoroughly by shaking.

This mixture should be well agitated whenever any of it is to be dispensed.

Each fluidrachm contains 7½ *minims of Copaiba.*

Note.—The above mixture has usually been prepared with Mucilage of Acacia; but if Mucilage of Dextrin (N. F.) be used, it will keep for a longer time without separating.

A mixture of somewhat similar composition, in considerable use in some parts of the country, is the following:

2. *Chapman's Mixture.*

Copaiba,	1½ fl. oz.
Spirit of Nitrous Ether,	1½ fl. oz.
Compound Tincture of Lavender,	360 min.
Tincture of Opium,	180 min.
Acacia, in fine powder,	180 gr.
Sugar,	180 gr.
Water, enough to make	16 fl. oz.

Note.—The original formula of Prof. Chapman varies somewhat from these proportions.

Alkaline Copaiba Mixture.

Copaiba,	4 fl. dr.
Acacia,	240 gr.
Sugar,	240 gr.
Solution of Potassa,	4 fl. dr.
Spearmint Water, a sufficient quantity to make	8 fl. oz.

Mix the Copaiba and Solution of Potassa; add the Water, and triturate with the Acacia and Sugar.

Diphtheria Mixture.

(Dr. Bergeron's.)

Copaiba,	20 min.
Syrup of Orange,	4 fl. dr.
Peppermint Water,	8 fl. dr.
Alcohol,	6 fl. oz.

Mix. Dose, a tablespoonful every two hours, in non-infectious diphtheria, to aid the disappearance of the false membrane.

Solution of Santal, Copaiba, and Cubeb.

(Nesbit's specific.)

Oil of Santal,	5 fl. oz.
Oil of Copaiba,	4 fl. dr.
Oil of Cubeb,	4 fl. dr.
Oil of Pimenta,	1 fl. dr.
Oil of Cassia,	1 fl. dr.
Alcohol, sufficient to make	16 fl. oz.

Mix. Dose, a teaspoonful twice a day in water.

Compound Fluid Extract of Buchu.

Oil of Juniper,	12 min.
Spirit of Nitrous Ether,	8 fl. oz.
Fluid Extract of Cubeb,	8 fl. oz.
Fluid Extract of Buchu,	10 fl. oz.

Dissolve the Oil of Juniper in the Spirit of Nitrous Ether, and mix with the Fluid Extracts. Do not filter; but shake well before dispensing.

Tinctura Lupulinæ. *U. S.* 1870. TINCTURE OF LUPULIN.

Lupulin,	4 oz. (troy).
Alcohol, a sufficient quantity.	

Pack the Lupulin in a narrow cylindrical percolator, and gradually pour Alcohol upon it until 32 fl. oz. of tincture are obtained.

Ethereal Tincture of Cannabis Indica.

Extract of Cannabis (Squire's),	240 gr.
Spirit of Nitrous Ether,	8 fl. oz.

Triturate together in a mortar till the Extract is dissolved. Dose, 5 to 15 drops.

Ethereal Tincture of Guaiac.

Guaiac,	1½ oz. (troy).
Spirit of Nitrous Ether,	8 fl. oz.

Make by maceration. Dose, a teaspoonful.

Anthelmintic Syrup.

Fluid Extract of Senna,	1 fl. dr.
Oil of Chenopodium,	1 fl. dr.
Syrup of Rhubarb,	2 fl. oz.

Mix. Dose, a teaspoonful three times a day.

Arnica Liniment.

Arnica Flowers,	2 oz. (av.).
Glycerin,	8 fl. oz.

Digest at a moderate temperature on a water-bath, express, and strain.

Syrup of Anthemis.

Anthemis,	240 gr.
Sugar,	10 oz. (av.).
Water,	6 fl. oz.

Make an infusion of the flowers with the Water, and add the Sugar, dissolving without heat.

392. **Tinctura Capsici et Myrrhæ.** *N. F.*

Tincture of Capsicum and Myrrh.

Hot Drops.

Capsicum, in No. 20 powder,	½ tr. oz.
Myrrh, in moderately coarse powder,	2 tr. oz.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Mix the powders with an equal bulk of clean, fine sand, and percolate them in the usual manner, with a mixture of *nine* (9) *volumes* of Alcohol, and *one* (1) *volume* of Water, until *sixteen* (16) *fluidounces* of percolate are obtained.

Note.—This preparation is known in some parts of this country by the old Thomsonian name "Number six."

Emulsion of Aspidium.

Fluid Extract of Aspidium,	1 fl. dr.
Tincture of Quillaia,	30 min.
Distilled Water, sufficient to make	1 fl. oz.

Mix.

409. **Tinctura Pimpinellæ.** *N. F.*

Tincture of Pimpinella.

Pimpinella Root,	2½ tr. oz.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Mix *two* (2) *volumes* of Alcohol with *one* (1) *volume* of Water. Macerate the Pimpinella, reduced to a moderately coarse (No. 40) powder, with enough of the menstruum to keep it distinctly damp during twelve hours. Then percolate it with the same menstruum, in the usual manner, until *sixteen* (16) *fluidounces* of Tincture are obtained.

Note.—This preparation is approximately of the same strength as that which is official in the Germ. Pharm. Pimpinella root is derived from *Pimpinella Saxifraga* Linné, and *Pimpinella magna* Linné.

Nerve Powder.

(Thomsonian name.)

Powdered Cypripedium.

Liniment of Stillingia.

Oil of Stillingia,	1 fl. oz.
Oil of Cajuput,	4 fl. dr.
Oil of Lobelia,	2 fl. dr.
Alcohol,	2 fl. oz.

Mix. Used as a local application in croup, and as a cough medicine, in doses of 1 drop on a lump of sugar.

103. Elixir Stillingiæ Compositum. *N. F.*

Compound Elixir of Stillingia.

Compound Fluid Extract of Stillingia,	4 fl. oz.
Aromatic Elixir,	12 fl. oz.

Mix them, allow the mixture to stand a few days, or longer, if convenient, and filter.

Each fluidrachm represents 15 minims of Compound Fluid Extract of Stillingia.

Syrup of Lactucarium.

(Aubergier's modified.)

Fluid Extract of Lactucarium (U. S.),	4 fl. dr.
Syrup of Orange Flowers,	4 fl. oz.
Syrup,	10 fl. oz.

Mix.

351. Syrupus Actææ Compositus. *N. F.*

Compound Syrup of Actæa.

Syrupus Cimicifugæ Compositus.* Compound Syrup of Cimicifuga (*or* Black Cohosh).

Fluid Extract of Cimicifuga,	800 min.
Fluid Extract of Glycyrrhiza,	150 min.
Fluid Extract of Senega,	150 min.
Fluid Extract of Ipecac,	75 min.
Wild Cherry, in moderately fine powder,	800 gr.
Purified Talcum,	120 gr.
Sugar,	10 tr oz.
Water, enough to make	16 fl. oz.

Mix the Wild Cherry with *six* (6) *fluidounces* of Water, and allow it to macerate during one hour. Then add to it the Fluid Extracts and the Talcum, and stir or agitate the mixture frequently and thoroughly during about fifteen minutes. Transfer it to a wetted filter and, when the liquid ceases to drop from the funnel, wash the contents of the filter with Water to obtain *eight* (8) *fluidounces* of filtrate. In this dissolve the Sugar by agitation, and add enough Water, previously passed through the filter, to make *sixteen* (16) *fluidounces.*

* Through an oversight by the committee, the title of this preparation should be "Syrupus Cimicifugæ Compositus" instead of "Syrupus Actææ Compositus;" the latter should be the synonyme.

Cough Lozenges.

(Keating's.)

Lactucarium,	120 gr.
Ipecac,	60 gr.
Squill,	45 gr.
Extract of Glycyrrhiza,	120 gr.
Sugar,	2 oz. (troy).

Mix. Make into a mass with Tragacanth and Mucilage, and divide into 20-grain lozenges.

RESINS, OLEORESINS, GUM-RESINS, AND BALSAMS.

122. Emulsio Olei Terebinthinæ. *N. F.*

Emulsion of Oil of Turpentine.

Oil of Turpentine,	½ fl. oz.
Acacia, in fine powder,	30 gr.
Yolk of Egg,	1.
Aromatic Elixir,	½ fl. oz.
Cinnamon Water, enough to make	4 fl. oz.

Triturate the Acacia with the Yolk of Egg, then add the Oil of Turpentine very slowly, continuing the trituration, and, finally, add the Water and Aromatic Elixir in the same manner.

Emulsion of Oil of Turpentine, or of any *Volatile Oil*, may also be prepared according to the following general formula:

Volatile Oil,	½ fl. oz.
Acacia, in fine powder,	120 gr.
Syrup,	1 fl. oz.
Water, enough to make	4 fl. oz.

Pour the Volatile Oil into a dry four-ounce bottle, and, having corked the latter, agitate it so that the inner surface may be completely wetted by the Oil. Then add the Acacia, and shake again. Finally, add the Syrup, and add enough Water to make *four* (4) *fluidounces*, and mix thoroughly by shaking.

Note.—If this general formula is applied to Emulsion of Oil of Turpentine, and a product similar to that obtained by the first formula is desired, the Syrup should be replaced by Aromatic Elixir, and the Water by Cinnamon Water.

If a so-called "emulsion" of a Volatile Oil is to be made more permanent, this may be accomplished by incorporating with it a small proportion of some bland fixed oil, such as Expressed Oil of Almond. Usually, 1 volume of the fixed oil will be sufficient for 2 volumes of the volatile oil.

In this case, the mixture should be made in a mortar, by trituration.

Emulsion of Turpentine.

(J. W. Forbes.)

Oil of Turpentine,	1 fl. oz.
Powdered Acacia,	20 gr.
Water,	4 fl. dr.

Place the Oil in a dry bottle, add the Powdered Acacia, shake well, and mix thoroughly with the Oil; lastly, add the Water, and shake the whole thoroughly.

Emulsion of Turpentine.

Oil of Turpentine,	20 min.
Tincture of Quillaia,	20 min.
Distilled Water,	1 fl. oz.

Mix.

Haarlem Oil.

Sulphurated Oil,	12 fl. oz.
Petroleum (Barbadoes),	4 fl. oz.
Oil of Amber (crude),	6 fl. oz.
Oil of Turpentine,	32 fl. oz.
Linseed Oil,	16 fl. oz.

Mix. The Sulphurated Oil is made by boiling 1 part of Sulphur with 8 parts of Olive Oil until they are united.

Thomson's Salve.

(Thomsonian name.)

Yellow Wax,	2 oz. (troy).
Fresh Butter,	2 oz. (troy).
Turpentine,	4 oz. (troy).
Balsam of Fir,	2 oz. (troy).

Mix.

Fever Liniment.

(Saint Barthelemy's.)

Oil of Turpentine,	34 fl. dr.
Tincture of Opium,	80 min.
Camphor,	50 gr.
Olive Oil,	2 fl. oz.

Mix. Apply for six minutes every six hours to the whole spine.

Mistura Pini Sylvestris.

(Dr. Piffard's.)

Tar,	100 gr.
Oil of Lavender,	100 gr.
Oil of Scotch Fir (*Pinus sylvestris*),	300 gr.

Mix and filter.

Ceratum Resinæ Compositum. *U. S.* 1870. Compound Resin Cerate. (Deshler's Salve.)

Resin,	
Suet,	
Yellow Wax, each,	6 oz. (troy).
Turpentine,	3 oz. (troy).
Oil of Flaxseed,	3½ oz. (troy).

Melt them together, strain the mixture through muslin, and stir it constantly until cool.

Compound Infusion of Myrrh.

Myrrh,	23 gr.
Aloes,	23 gr.
Saffron,	23 gr.
Potassium Carbonate,	15 gr.
Powdered Extract of Glycyrrhiza,	120 gr.
Water,	6 fl. oz.
Compound Tincture of Cardamom,	2 fl. oz.

Boil slowly to 4 fl. oz., strain, and add the Compound Tincture of Cardamom.

Breast Plaster.

(Dewees'.)

Ammoniac Plaster,	120 gr.
Lead Plaster,	1½ oz. (troy).
Logan's Plaster,	360 gr.
Spermaceti,	60 gr.
Camphor,	60 gr.

Melt the Plaster, then add the Spermaceti and Camphor, and remove from the fire.

Sedative Pills.

(Gunther's.)

Powdered Asafetida,	57 gr.
Extract of Valerian,	57 gr.
Extract of Belladonna,	3 gr.
Oxide of Zinc,	1 gr.
Castor,	2 gr.

Mix, and make into 24 pills. Dose, 1 to 2 pills twice daily in chorea.

Syrup of Asafetida.

Asafetida,	240 gr.
Sugar,	16 oz. (av.).
Boiling Water,	8 fl. oz.

Rub the Asafetida with part of the Boiling Water until a uniform paste is made, then gradually add the rest of the Water, strain, and add the Sugar, using a gentle heat to dissolve it. Dose, a tablespoonful.

Liniment of Hypericum.

(Red Oil.)

Flowers of Hypericum (fresh),	8 oz. (troy).

Olive Oil, a sufficient quantity to cover the flowers.

Macerate in the sun for fourteen days, express, and strain.

399. Tinctura Guaiaci Composita. *N. F.*

Compound Tincture of Guaiac.

Dewees' Tincture of Guaiac.

Resin of Guaiac,	2 tr. oz.
Carbonate of Potassium,	45 gr.
Pimenta, in moderately fine powder,	240 gr.
Pumice, in fine powder,	1 tr. oz.
Alcohol,	7 fl. oz.
Water,	8 fl. oz.
Diluted Alcohol, enough to make	16 fl. oz.

Triturate the Resin of Guaiac and Carbonate of Potassium with the Pimenta and the Pumice, and afterwards gradually with the Alcohol. Next add slowly *seven* (7) *fluidounces* of cold Water and triturate the mixture thoroughly. Then filter, and pass enough Diluted Alcohol through the filter to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 7½ grains of Resin of Guaiac.

Emulsion of Guaiac.

Guaiac (powdered),	12 gr.
Tincture of Quillaia,	1 fl. dr.
Distilled Water,	1 fl. oz.

Dissolve the Guaiac in the Tincture, filter, and then mix with the Water.

Syrup of Guaiac.

Guaiac (powdered),	640 gr.
Potassa,	58 gr.
Sugar,	16 oz (av.).
Water, sufficient to make	8 fl. oz.

Dissolve the Potassa in 8 fl. oz. of Water, add the Guaiac, macerate seven days, filter, add the Sugar, and strain.

258. Mistura Guaiaci. *N. F.*

Mixture of Guaiac.

Resin of Guaiac,	190 gr.
Sugar,	190 gr.
Acacia, in fine powder,	100 gr.
Cinnamon Water,	16 fl. oz.

Triturate the Resin of Guaiac with the Sugar and Acacia, then gradually add the Cinnamon Water.

This mixture should be well agitated whenever any of it is to be dispensed.

Note.—This preparation is practically identical with the *Mistura Guaiaci* of the Brit. Pharm.

259. Mistura Oleo-Balsamica. *N. F.*

Oleo-Balsamic Mixture.

Mixtura Oleoso-Balsamica (*Germ. Pharm.*). Balsamum Vitæ Hoffmanni.

Oil of Lavender,	30 min.
Oil of Thyme,	30 min.
Oil of Lemon,	30 min.
Oil of Mace,	30 min.
Oil of Orange Flowers,	30 min.
Oil of Cloves,	25 min.
Oil of Cinnamon,	25 min.
Balsam of Peru,	80 min.
Alcohol, enough to make	16 fl. oz.

Dissolve the Oils and the Balsam of Peru in the Alcohol, let the solution stand a few days, and then filter.

416. Tinctura Tolutana Solubilis. *N. F.*

Soluble Tincture of Tolu.

Balsam of Tolu,	1¼ tr. oz.
Carbonate of Magnesium,	60 gr.
Glycerin,	6 fl. oz.
Water,	
Alcohol, each, enough to make	16 fl. oz.

Mix *three* (3) *fluidounces* of Alcohol with the Glycerin, and dissolve the Balsam of Tolu in the mixture with the aid of heat, avoiding loss by evaporation. Next add *six* (6) *fluidounces* of Water, and allow the mixture to become cold. Pour off the milky liquid from the resinous precipitate (which latter is to be rejected), mix it with the Carbonate of Magnesium by trituration, and filter. Lastly, pass enough of a mixture of *one* (1) *volume* of Alcohol and *two* (2) *volumes* of Water through the filter to make the whole filtrate measure *sixteen* (16) *fluidounces*.

Note.—This preparation may be added to Syrup or Water without producing cloudiness. A mixture of 1 fluidounce of this preparation with 15 fluidounces of Syrup yields a product which may be used as Syrup of Tolu in all cases where the officinal preparation is not required.

Pills Number Three (Anti-Canker).

(Thomsonian name.)

Capsicum,	1 oz. (av.).
Extract of Bayberry,	1 oz. (av.).

Make into pills.

Number Five.

(Restorative Cordial.)

(Thomsonian name.)

White Aspen,	
Black Aspen,	
Poplar Bark, of each,	8 oz. (av.).
Bayberry Root Bark,	16 oz. (av.).

Boil a few minutes in 2 gallons of Water, strain, add 7 pounds of Sugar, skim, and then add 8 quarts of Brandy.

317. Pulvis Myricæ Compositus. *N. F.*

Compound Powder of Bayberry.

Composition Powder.

Bayberry, bark of the root,	12 parts.
Ginger,	6 parts.
Capsicum,	1 part.
Cloves,	1 part.

Reduce the substances to a moderately fine powder.

Note.—Bayberry root bark is derived from *Myrica cerifera* Linné (Waxmyrtle; Candleberry).

Syrup of Bayberry.

(Thomsonian name.)

Bayberry,	12 oz. (troy).
Sugar,	12 oz. (troy).
Diluted Alcohol,	64 fl. oz.

Digest the Bayberry in the Diluted Alcohol for two days, strain, and evaporate to 16 fl. oz.; add the Sugar.

Tolu Cough Mixture.

Syrup of Squill,	4 fl. dr.
Tincture of Tolu,	1 fl. dr.
Syrup,	8 fl. oz.

Mix. Dose, a teaspoonful.

8. Balsamum Traumaticum. *N. F.*

Traumatic Balsam.

Turlington's Balsam. Friar's Balsam.

Benzoin, in coarse powder,	1½ tr. oz.
Storax,	¾ tr. oz.
Balsam of Tolu,	¾ tr. oz.
Balsam of Peru,	120 gr.
Aloes, in coarse powder,	60 gr.
Myrrh, in coarse powder,	60 gr.
Angelica Root, in moderately coarse powder,	30 gr.
Alcohol,	16 fl. oz.

Macerate the substances with the Alcohol during ten days, frequently agitating; then filter.

Note.—The officinal *Tinctura Benzoini Composita* is a simplified preparation intended to replace the above compound.

Borobenzoate of Sodium.

(T. S. Wiegand.)

Sodium Borate,	8 oz. (troy).
Sodium Benzoate,	4 oz. (troy).
Water, sufficient to dissolve.	

Make a solution of the Salts in the Water, filter, and evaporate, with constant stirring, to dryness.

FATS, FIXED OILS, SOAPS, ETC.

British Oil.

Petroleum, Barbadoes,	1 fl. oz.
Petroleum, American,	1 fl. oz.
Oil of Turpentine,	2 fl. oz.
Oil of Linseed,	24 fl. oz.
Oil of Amber,	8 fl. oz.
Oil of Juniper,	2 fl. dr.

Mix them well together.

309. Pulvis Amygdalæ Compositus. *N. F.*

Compound Powder of Almond.

Sweet Almond,	6 parts.
Sugar, in fine powder,	8 parts.
Acacia, in fine powder,	1 part.

Blanch the Sweet Almonds, then dry them thoroughly with a soft cloth, and rub them lightly in a mortar, until they form a mass of a smooth consistence. Mix the Acacia and Sugar, add them to the mass previously prepared, and rub the whole to a coarse powder, which is to be preserved in a lightly-covered jar.

Note.—If 820 grains of this preparation be thoroughly triturated with 17 fluidounces of Water, gradually added, and the mixture finally strained, the product will be about 16 fluidounces of *Mistura Amygdalæ* (U. S. P.).

Emulsion of Pumpkin-Seed.

Pumpkin-Seed (fresh),	2 oz. (av.).
Powdered Acacia,	60 gr.
Sugar,	240 gr.
Water,	4 fl. oz.

Blanch the seed, after soaking them in hot water, beat them into a mass with the Sugar, then add the Acacia, and gradually the Water.

121. Emulsio Olei Ricini. *N. F.*

Emulsion of Castor Oil.

I. Irish Moss Emulsion of Castor Oil.

Castor Oil,	5 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Tincture of Vanilla,	180 min.
Syrup,	8 fl. oz.
Water,	enough to make 16 fl. oz.

To the Mucilage of Chondrus, contained in a suitable bottle, add the Castor Oil in divided portions, agitating each time until the last-added portion has been emulsified. Then add the Tincture of Vanilla, the Syrup, and enough Water to make *sixteen* (16) *fluidounces*. Finally, mix the whole thoroughly together.

This emulsion should not be prepared in larger quantity than may be consumed within a short time.

Emulsion of Castor Oil may also be prepared by other methods capable of emulsifying the oil, provided the vehicles and ingredients are compatible with the therapeutic employment of the preparation. In absence of any specific directions of the prescriber, it is recommended that Castor Oil Emulsion be prepared only either by means of Chondrus or by means of Acacia.

II. Acacia Emulsion of Castor Oil. *N. F.*

Castor Oil,	5 fl. oz.
Acacia, in fine powder,	1¼ tr. oz.
Tincture of Vanilla,	180 min.
Syrup,	8 fl. oz.
Water,	enough to make 16 fl. oz.

Mix the Syrup with *two* (2) *fluidounces* of Water, and triturate the Acacia with the mixture to a smooth paste. Then gradually incorporate with it the Castor Oil. Transfer the mixture to a bottle, add the Tincture of Vanilla, and enough Water to make *sixteen* (16) *fluidounces*. Finally, mix the whole thoroughly together.

This emulsion should not be prepared in larger quantity than may be consumed within a short time.

Emulsion of Castor Oil.

Castor Oil,	4 fl. dr.
Tincture of Quillaia,	30 min.
Distilled Water, sufficient to make	1 fl. oz.

Mix.

200. Linimentum Tiglii. *N. F.*

Liniment of Croton Oil.

Linimentum Crotonis (*Brit. Ph.*).

Croton Oil,	2 fl. dr.
Oil of Cajuput,	7 fl. dr.
Alcohol,	7 fl. dr.

Mix them.

201. Linimentum Tiglii Compositum. *N. F.*

Compound Croton Oil Liniment.

Croton Oil,	1 fl. oz.
Oil of Sassafras,	1 fl. oz.
Oil of Turpentine,	1 fl. oz.
Oil of Olive,	2 fl. oz.

Mix them.

Ointment of Croton Oil.

Croton Oil,	30 min.
Lard,	1 oz. (troy).

Mix gradually.

Pills of Croton Oil.

Croton Oil,	6 min.
Crumb of Bread,	24 gr.

Make into 24 pills.

Croton Oil Pencils.

(Limousin's.)

Croton Oil,	2 fl. dr.
White Wax,	60 gr.
Oil of Theobroma,	60 gr.

Melt the Wax and Oil of Theobroma together, by means of a water-bath, in a flask, adding the Croton Oil, and keep the flask corked until the mixture begins to congeal; then pour into suitable cylindrical moulds, one-fourth to one-third of an inch in diameter. The pencils are covered with tin foil and kept in closed vessels.

Stronger Laxative Mixture.

(Bossu's.)

Resin of Scammony, Resin of Jalap, of each,	½ gr.
Sugar,	15 gr.
Croton Oil,	2 min.
Mucilage,	30 min.
Orange Flower Water,	90 min.
Compound Syrup of Senna,	1 fl. oz.
Peppermint Water,	8 fl. oz.

Dose, a tablespoonful.

Glycerin Ointment.

Spermaceti,	240 gr.
White Wax,	60 gr.
Glycerin,	1 fl. oz.
Expressed Oil of Almond,	8 fl. oz.

Melt the Wax and Spermaceti with the Oil at a moderate heat; put these in a Wedgwood mortar, add the Glycerin, and triturate until cold.

Glycerin Suppositories.

Sodium Carbonate,	40 gr.
Stearic Acid,	80 gr.
Glycerin,	1080 gr.

Dissolve the Sodium Carbonate in the Glycerin, add the Stearic Acid; heat carefully, make 12 suppositories, wrap each in tin foil. Each suppository contains ninety per cent. of Glycerin.

341. Spiritus Glonoini. *N.*

Spirit of Glonoin.

Spirit of Nitroglycerin. Solution of Nitroglycerin.

A solution of Glonoin (or Nitroglycerin) in officinal Alcohol, containing *one* (1) *per cent.*, by weight, of the former.

Note.—The specific gravity of this Spirit, at 15° C. (59° F.) is 0·828. On mixing 10 C.c. of the Solution with Distilled Water, in a test-tube having a diameter of ⅝ inch, both liquids being at the temperature of 15° C. (59° F.), it will require about 16 C.c. of the Water to render the liquid faintly turbid (when compared with the undiluted Solution); and about 4 C.c. more of Water will be required to render it so opalescent that the eye cannot distinguish print placed behind the tube.

Glonoin (or Nitroglycerin), for medical purposes, is usually procured by wholesale dealers in drugs directly from the factory where it is made, in form of a 10 per cent. solution in alcohol. Such a solution is non-explosive, and may be diluted, as occasion requires, to the strength of 1 per cent. The specific gravity of the 10 per cent. solution is 0·863 at 15° C. (59° F.). Ten C.c. of it require about 2.5 C.c. of Distilled Water to render it so opalescent that print cannot be distinguished through it under the conditions just described in the case of the 1 per cent. solution.

Solutions of Glonoin, particularly the stronger (10 per cent.), should always be transported or kept in tin cans, and *never in glass* or other fragile vessels. Should the container of a Solution of Glonoin be broken, and the contents be soaked up by wood, or packing material, the latter may become dangerously explosive when the alcohol has evaporated. Should the proportion of Glonoin to porous material be not more than 70 parts of the former, and not less than 30 parts of the latter, the compound will be non-explosive (except by a detonator); and if the proportions are not more than 52 parts of the former, and not less than 48 parts of the latter, the compound cannot even be detonated. But, in presence of substances readily yielding oxygen, such as nitrates, chlorates, etc., so small a proportion as 5 per cent. of Glonoin will produce a dangerously explosive combination.

When handling an alcoholic solution of Glonoin, care should be taken that it be not brought in prolonged or extended contact with the skin, as it is readily absorbed and will then cause its characteristic physiological effects (distressing headache, nausea, etc.).

296. Pilulæ Glonoini. *N. F.*

Pills of Glonoin.

Pills of Nitroglycerin.

Spirit of Glonoin (N. F., 1 per cent.),	200 gr.
Althæa, in fine powder,	198 gr.
Confection of Rose, a sufficient quantity.	

Mix the Spirit of Glonoin intimately with the powdered Althæa, expose the mixture for a short time to the air, so that the alcohol may evaporate, then make a pill-mass by means of Confection of Rose, and divide it into *two hundred* (200) *pills*.

Each pill contains $\frac{1}{100}$ grain of Glonoin (Nitroglycerin).

Ceratum Saponis. *U. S.* 1870.

Soap Cerate.

Soap Plaster,	2 oz. (troy).
Yellow Wax,	2½ oz. (troy).
Olive Oil,	4 oz. (troy).

Melt together the Plaster and Wax, add the Oil, and, after continuing the heat a few minutes, stir the mixture until cool.

Pilula Saponis Composita. *U. S.* 1870.

Compound Pill of Soap.

Opium, in fine powder,	60 gr.
Soap, in fine powder,	240 gr.

Beat them together with water so as to form a pilular mass.

Bathing Spirits.

(Jackson's.)

Soap,	8 oz. (troy).
Camphor,	8 oz. (troy).
Oil of Rosemary,	8 fl. dr.
Oil of Thyme,	8 fl. dr.
Alcohol,	64 fl. oz.

Mix.

198. Linimentum Saponato-Camphoratum. *N. F.*

Camphorated Soap Liniment.

Opodeldoc. Solid Opodeldoc.

White Castile Soap, dried and powdered,	1¼ tr. oz.
Camphor,	½ tr. oz.
Alcohol,	20 fl. oz.
Oil of Thyme,	30 min.
Oil of Rosemary,	60 min.
Stronger Water of Ammonia (U. S. P.),	1 fl. oz.

Introduce the Castile Soap, Camphor, and Alcohol into a flask or suitable bottle, and apply a gentle heat until solution is effected, taking care that no loss of Alcohol be incurred by evaporation. Filter the liquid, while hot, into another flask or bottle; warm again, if necessary, to render the contents liquid, add the Oils and Stronger Water of Ammonia, and when the whole has been thoroughly mixed, pour it into small dry vials, which should have been previously warmed, and should immediately be corked and cooled.

Note.—The quantities above given are usually divided into 12 vials. Solid Opodeldoc is directed by the Germ. Pharm. to be made with soap made from animal fats; but pure, white Castile soap may be used, provided it is previously deprived of water. The stronger Water of Ammonia should be of the full strength prescribed by the U. S. Pharm.

329. Sapo Viridis. *N. F.*

Green Soap.

Potassa,	8 parts.
Water,	12 parts.
Cotton-Seed Oil,	24 parts.

Dissolve the Potassa in the Water and, while stirring the solution, add the Cotton-Seed Oil. Stir it occasionally during forty-eight hours, then transfer the product to suitable vessels.

Note.—If refined Cotton-Seed Oil is used for this preparation, the product will have a yellowish color, free from greenish tint, but will answer the same purpose.

345. Spiritus Saponatus. *N. F*

Spirit of Soap.

Castile Soap, in shavings,	2½ tr. oz.
Alcohol,	9 fl. oz.
Water,	enough to make 16 fl. oz.

Introduce the Soap into a bottle, add the Alcohol and *three* (3) *fluidounces* of Water, cork the bottle, and immerse it in hot Water, frequently shaking. When the Soap is dissolved, allow the bottle and contents to become cold, then add enough Water to make *sixteen* (16) *fluidounces*, and filter.

Note.—The *Spiritus Saponatus* of the Germ. Pharm. is prepared by saponifying Olive Oil with Potassa, and then adding Alcohol and Water.

If time permits, the Spirit ought to be set aside, in a moderately cold place, for about twelve hours before it is filtered.

Compound Tincture of Green Soap.

(Tilbury Fox.)

Green Soap,	1 oz. (troy).
Oil of Lavender,	90 min.
Oil of Cade,	
Alcohol, of each,	1 fl. oz.

Mix.

414. Tinctura Saponis Viridis Composita. *N. F.*

Compound Tincture of Green Soap.

Green Soap,	2½ tr. oz.
Oil of Cade,	140 min.
Alcohol,	enough to make 16 fl. oz.

Dissolve the Green Soap in *twelve* (12) *fluidounces* of Alcohol, add the Oil of Cade, and then enough Alcohol to make the product measure *sixteen* (16) *fluidounces*, and filter.

Green Soap Lotion.

(Hebra's.)

Green Soap,	240 gr.
Oil of Lavender,	15 min.
Boiling Water,	8 fl. oz.

Mix.

Tincture of Green Soap with Tar.

(Hebra's.)

Green Soap,	1 oz. (troy).
Tar,	
Alcohol, of each,	1 fl. oz.

DRUGS CONTAINING BITTER PRINCIPLES, ETC.

394. Tinctura Coto. *N. F.*

Tincture of Coto.

Coto Bark, bruised,	2 tr. oz.
Alcohol,	enough to make 16 fl. oz.

Macerate the Coto with *fourteen* (14) *fluidounces* of Alcohol during seven days; then pour off the liquid, press the residue, and filter the united liquids through paper. Lastly, wash the residue transferred to the filter with enough Alcohol to make the product measure *sixteen* (16) *fluidounces*.

Note.—Coto Bark is derived from an undetermined tree, probably belonging to the natural order Lauraceæ, and is obtained from Bolivia. There are two varieties known, one as "Coto" and the other as "Paracoto" bark. True Coto bark is, at times, difficult to obtain in the market, and the Paracoto bark is then frequently substituted for it. While they possess some useful properties in common, yet they differ materially in other respects. Hence, the Paracoto bark should not be substituted for the true Coto bark.

Tonic Tea.

(Gerhard's.)

Gentian,	1 oz. (troy).
Rhubarb,	120 gr.
Ginger,	240 gr.
Sodium Bicarbonate,	120 gr.
Boiling Water,	32 fl. oz.

Bruise the Gentian, Rhubarb, and Ginger, mix them, and add the Sodium Bicarbonate; then infuse in 32 fl. oz. of Boiling Water. Dose, a wineglassful three times a day.

Elixir of Gentian with Chloride of Iron.

Compound Fluid Extract of Gentian,	4 fl. dr.
Tincture of Chloride of Iron (tasteless),	2½ fl. dr.
Elixir of Orange, a sufficient quantity to make	8 fl. oz.

Mix.

Tincture of Burdock-Seed.

Ground Burdock-Seed,	4 oz. (troy).
Water,	4 fl. oz.
Alcohol,	12 fl. oz.

Mix the liquids, and percolate in the usual way until 16 fl. oz. of tincture are obtained. Dose, a teaspoonful three or four times a day.

Boker's Bitters.

Quassia,	60 gr.
Calamus,	60 gr.
Catechu,	60 gr.
Cardamom,	40 gr.
Orange Peel,	90 gr.
Whisky,	5¼ fl. oz.
Water,	24 fl. oz.

Macerate, and filter.

Pilulæ Scillæ Compositæ. *U. S.* 1870.

COMPOUND PILLS OF SQUILL.

Squill, in fine powder,	12 gr.
Ginger, in fine powder,	
Ammoniac, in fine powder, of each,	24 gr.
Soap, in fine powder,	36 gr.
Syrup, a sufficient quantity.	

Mix the powders, then beat them with Syrup so as to form a pilular mass. To be divided into 24 pills.

Tinctura Hellebori. *U. S.* 1870. TINCTURE OF BLACK HELLEBORE.

Black Hellebore, in moderately fine powder,	4 oz (troy).
Diluted Alcohol, a sufficient quantity.	

Moisten the powder with 1 fl. oz. of Diluted Alcohol, pack it in a cylindrical percolator, and gradually pour Diluted Alcohol upon it until 2 pints of tincture are obtained.

Cutter's Pills.

(For habitual costiveness.)

Powdered Ipecac,	10 gr.
Mild Chloride of Mercury,	8 gr.
Extract of Taraxacum,	40 gr.

Make into a mass and divide into 30 pills. Dose, one three times a day.

Laxative Syrup.

(Amussart's.)

Rasped Guaiac Wood,	
Chicory Root,	
Lappa,	
Water-Dock Root,	
Fumitory Tops,	
Tops of Viola Tricolor, of each,	154 gr.
Senna,	770 gr.
Sugar,	
Honey, of each,	10½ oz. (av.).
Boiling Water, sufficient.	

Bruise the materials, and infuse for twelve hours with 18 fl. oz. of Boiling Water; strain, and make a second infusion with 10 fl. oz. of Water; strain under pressure, filter through paper (evaporate to one-fourth), then add the Honey and Sugar and shake until dissolved; strain. Dose, 1 to 2 tablespoonfuls a day.

67. Elixir Gentianæ. *N. F.*

Elixir of Gentian.

Extract of Gentian (U. S. P.),	70 gr.
Aromatic Spirit,	180 min.
Tincture of Vanilla,	120 min.
Syrup,	1 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Extract of Gentian in about *two* (2) *fluidounces* of Aromatic Elixir, next add the Syrup, Aromatic Spirit, and Tincture of Vanilla, and, lastly, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm represents about 2 *grains of Gentian.*

Note.—This Elixir will be more likely to remain clear if, after the liquids are mixed together, 360 grains of Purified Talcum are added, the whole allowed to stand a few days, and then filtered.

68. Elixir Gentianæ et Ferri Phosphatis. *N. F.*

Elixir of Gentian and Phosphate of Iron.

Elixir Gentianæ Ferratum. Ferrated Elixir of Gentian. Ferrophosphated Elixir of Gentian.

Phosphate of Iron (U. S. P. 1880),	128 gr.
Water,	½ fl. oz.
Elixir of Gentian, enough to make	16 fl. oz.

Dissolve the Phosphate of Iron in the Water with the aid of heat, and add

enough Elixir of Gentian to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm represents 1 grain of Phosphate of Iron and nearly 2 grains of Gentian.

69. Elixir Gentianæ cum Tinctura Ferri Chloridi. *N. F.*

Elixir of Gentian with Tincture of Chloride of Iron.

Tincture of Citro-Chloride of Iron,	640 min.
Elixir of Gentian, enough to make	16 fl. oz.

Mix the Tincture of Citro-Chloride of Iron with enough Elixir of Gentian to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm represents about ¾ grain of Ferric Chloride and nearly 2 grains of Gentian.

52. Elixir Corydalis Compositum. *N. F.*

Compound Elixir of Corydalis.

Fluid Extract of Corydalis,	1 fl. oz.
Fluid Extract of Stillingia,	1 fl. oz.
Fluid Extract of Xanthoxylum,	½ fl. oz.
Fluid Extract of Iris,	1½ fl. oz.
Alcohol,	2 fl. oz.
Iodide of Potassium,	384 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Alcohol with the Fluid Extracts, dissolve the Iodide of Potassium in the mixture, and add enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Let the mixture stand a few days, if convenient, and filter.

Each fluidrachm contains 3 grains of Iodide of Potassium and small quantities of the several Fluid Extracts.

58. Elixir Euonymi. *N. F.*

Elixir of Euonymus.

Elixir of Wahoo.

Fluid Extract of Euonymus,	2½ fl. oz.
Water,	2 fl. oz.
Syrup of Coffee,	2 fl. oz.
Compound Elixir of Taraxacum,	9½ fl. oz.

Mix them, let the mixture stand forty-eight hours, and filter.

Each fluidrachm represents about 9½ grains of Euonymus.

54. Elixir Eriodictyi Aromaticum. *N. F.*

Aromatic Elixir of Eriodictyon.

Aromatic Elixir of Yerba Santa; Elixir Corrigens.

Fluid Extract of Eriodictyon,	1 fl. oz.
Syrup,	8 fl. oz.
Pumice, in fine powder,	¼ tr. oz.
Carbonate of Magnesium,	80 gr.
Compound Elixir of Taraxacum, enough to make	16 fl. oz.

Mix *seven* (7) *fluidounces* of Compound Elixir of Taraxacum with the Syrup and Pumice, then add the Fluid Extract, and mix the whole thoroughly by agitation. Shake the mixture occasionally during two hours, then allow it to settle, and carefully decant the liquid into a funnel, the neck of which contains a small pellet of absorbent cotton. Afterwards add the dregs and allow them to drain. To the filtrate add the Carbonate of Magnesium and shake occasionally during several hours. Let the mixture stand at rest during twelve hours, if convenient, then decant the liquid and filter it through paper. To the filtrate add enough Compound Elixir of Taraxacum, if necessary, to make *sixteen* (16) *fluidounces*.

Note.—This preparation is chiefly intended as a vehicle for quinine and other bitter remedies.

106. Elixir Turneræ. *N. F.*

Elixir of Turnera.

Elixir of Damiana.

Fluid Extract of Turnera,	2½ fl. oz.
Carbonate of Magnesium,	240 gr.
Alcohol,	4 fl. oz.
Glycerin,	1 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Fluid Extract with the Alcohol, Glycerin, and *eight* (8) *fluidounces* of Aromatic Elixir. Incorporate the Carbonate of Magnesium thoroughly with the mixture by trituration. Then filter through a wetted filter, and pass enough Aromatic Elixir through the filter to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about 9½ grains of Turnera.

170. Extractum Stillingiæ Fluidum Compositum. *N. F.*

Compound Fluid Extract of Stillingia.

Stillingia,	4 tr. oz.
Corydalis (root),	4 tr. oz.
Iris,	2 tr. oz.
Sambucus,	2 tr. oz.
Chimaphila,	2 tr. oz.
Coriander,	1 tr. oz.
Xanthoxylum Berries,	1 tr. oz.

Reduce the drugs to a moderately coarse (No. 40) powder, and prepare a Fluid Extract in the usual manner with diluted alcohol.

384. Syrupus Stillingiæ Compositus. *N. F.*

Compound Syrup of Stillingia.

Compound Fluid Extract of Stillingia (N. F.),	4 fl. oz.
Purified Talcum,	120 gr.
Sugar,	11 tr. oz.
Water, enough to make	16 fl. oz.

Mix the Compound Fluid Extract of Stillingia with the Purified Talcum, and afterwards with *four and one-half* (4½) *fluidounces* of Water, and shake them together thoroughly. Then pour the mixture upon a wetted filter, add the Sugar to the filtrate, and pass enough Water through the filter to make the product, after the Sugar has been dissolved by agitation, measure *sixteen* (16) *fluidounces.*

Each fluidrachm represents 15 *minims of Compound Fluid Extract of Stillingia.*

431. Vinum Fraxini Americanæ. *N. F.*

Wine of White Ash.

Fraxinus (bark), in No. 40 powder,	8 tr. oz.
Stronger White Wine (U. S. P.),	enough to make 16 fl. oz.

Moisten the powdered Fraxinus with *sixteen* (16) *fluidounces* of Stronger White Wine, macerate it during three days in a well-covered vessel, then pack it in a percolator, and gradually pour on Stronger White Wine until *sixteen* (16) *fluidounces* of percolate are obtained. Keep the product in well-stoppered bottles, which should be completely filled and stored in a cool place.

Each fluidrachm represents 30 *grains of Fraxinus* (*bark*).

Note.—Fraxinus bark is the inner bark of the trunk or root of *Fraxinus Americana* Linné (White Ash).

105. Elixir Taraxaci Compositum. *N. F.*

Compound Elixir of Taraxacum.

Taraxacum,	1 tr. oz.
Wild Cherry,	1 tr. oz
Sweet Orange Peel, recently dried,	1 tr. oz.
Glycyrrhiza, Russian, peeled,	3 tr. oz.
Cinnamon, Saigon,	120 gr.
Cardamom,	120 gr.
Canada Snake Root,	120 gr.
Caraway,	120 gr.
Cloves,	40 gr.
Alcohol,	
Water, each,	a sufficient quantity.
Syrup,	32 fl. oz.

Reduce the solid substances to a moderately coarse (No. 40) powder, and percolate, in the usual manner, with a mixture of *one* (1) *volume* of Alcohol and *two* (2) *volumes* of Water, until *sixteen* (16) *fluidounces* of percolate are obtained. Lastly, add the Syrup, let the mixture stand a few days, if possible, and filter.

Note.—If a precipitate should make its appearance in this preparation on standing, it ought to be removed by filtration. This Elixir is chiefly intended as a vehicle or corrigent, to cover the bitter taste of quinine and similar substances.

388. Tinctura Amara. *N. F.*

Bitter Tincture.

Stomachic Tincture. Bitter Stomachic Drops. Stomach Drops.

Gentian,	384 gr.
Centaury (herb),	384 gr.
Bitter Orange Peel,	256 gr.
Orange Berries,	128 gr.
Zedoary (root),	128 gr.
Alcohol,	
Water, each,	enough to make 16 fl. oz.

Reduce the drugs to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with a mixture of *two* (2) *volumes* of Alcohol and *one* (1) *volume* of Water, until *sixteen* (16) *fluidounces* of percolate are obtained.

Note.—Centaury is the herb of *Erythræa Centaurium* Persoon. Orange Berries are the unripe fruit of *Citrus vulgaris* Risso, collected while small. Zedoary is the rhizome of *Curcuma Zedoaria* Roscoe. The product obtained by the above formula is practically identical with that which is officinal in the Germ. Pharm.

434. Vinum Pruni Virginianæ. *N. F.*

Wine of Wild Cherry.

Wild Cherry, in No. 40 powder,	4 tr. oz.
Sugar,	2½ tr. oz.
Water,	3 fl. oz.
Alcohol,	1 fl. oz.
Purified Talcum,	120 gr.
Angelica Wine, enough to make 16 fl. oz.	

Dissolve the Sugar in the Water. Moisten the Wild Cherry with a sufficient quantity of this solution, and allow it to macerate during one hour. Then transfer it to a percolator, pour upon it the remainder of the solution, and afterwards enough Angelica Wine until *fifteen* (15) *fluidounces* of percolate are obtained. Add to this the Alcohol, mix the Purified Talcum intimately with the liquid, then filter, returning the first portions of the filtrate until it runs through clear, and, finally, pass enough Angelica Wine through the filter to make the product measure *sixteen* (16) *fluidounces.*

Each fluidrachm represents 15 *grains of Wild Cherry.*

435. Vinum Pruni Virginianæ Ferratum. *N. F.*

Ferrated Wine of Wild Cherry.

Tincture of Citro-Chloride of Iron,	640 min.
Wine of Wild Cherry,	enough to make 16 fl. oz.

Mix the Tincture with enough Wine of Wild Cherry to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 5 *minims of Tincture of Citro-Chloride of Iron and* 18¾ *grains of Wild Cherry.*

418. Tinctura Zedoariæ Amara. *N.F.*

Bitter Tincture of Zedoary.

Compound Tincture of Zedoary.

Zedoary (root),	4 tr. oz.
Aloes,	2 tr. oz.
Rhubarb,	1 tr. oz.
Gentian,	1 tr. oz.
White Agaric,	1 tr. oz.
Saffron,	1 tr. oz.
Glycerin,	2 fl. oz.
Alcohol,	
Water, each, enough to make	16 fl. oz.

Reduce the solids to a moderately coarse (No. 40) powder, moisten this with a sufficient quantity of a mixture of *two* (2) *volumes* of Alcohol and *one* (1) *volume* of Water, and percolate it in the usual manner, with this menstruum, until *twelve* (12) *fluidounces* of percolate are obtained. Add to this the Glycerin and set it aside. Then continue the percolation until the drugs are practically exhausted, evaporate the new percolate to *two* (2) *fluidounces* and add it to the reserved portion.

Each fluidrachm represents 15 grains of Zedoary, 7½ grains of Aloes, and 3¾ grains, each, of the other drugs.

Note.—The above preparation is not identical with the *Tinctura Zedoariæ Composita* (also known as *Tinctura Carminativa, Tinctura Wedelii*) which was formerly officinal in some continental pharmacopœias.

410. Tinctura Quillajæ. *N. F.*

Tincture of Quillaja.

Quillaja, in fine chips,	8 tr. oz.
Alcohol,	1 pint.
Water, enough to make	8 pints.

Place the Quillaja in a suitable vessel with *two* (2) *pints* of Water, and boil it for fifteen minutes, then strain and add enough Water through the strainer to make the strained decoction, when cold, measure *two* (2) *pints*. Pour this into a bottle containing the Alcohol, let the mixture stand twelve hours, then filter it through paper, and add enough Water to the filtrate to make it measure *three* (3) *pints*.

Each fluidrachm represents 10 grains of Quillaja.

Note.—This preparation, aside from its therapeutic use, may be employed as an emulsifying agent for oils, balsams, resins. See *Note* to No. 114, IV. "Quillaja Emulsion of Cod-Liver Oil."

415. Tinctura Strophanthi. *N. F.*

Tincture of Strophanthus.

Strophanthus (seeds), freed from their comose appendage, reduced to No. 30 powder, and dried at 50° C. (122° F.),	1 tr. oz.
Stronger Ether,	a sufficient quantity.
Alcohol, enough to make	20 fl. oz.

Pack the Strophanthus in a suitable percolator, pour on enough Stronger Ether to saturate the powder thoroughly, cover the percolator, and macerate during twenty-four hours. Then allow the percolation to proceed, gradually pouring on Stronger Ether, until the liquid passes through colorless. This ethereal percolate is to be rejected. Remove the marc from the percolator, and dry it, first by exposure to air, and then at a temperature of 50° C. (122° F.). Again reduce it to powder, moisten it with Alcohol, repack it in the percolator, and macerate during forty-eight hours. Then percolate it with Alcohol, in the usual manner, until *twenty* (20) *fluidounces* of Tincture are obtained.

Each fluidrachm represents 3 grains of Strophanthus. The dose is about 2 to 10 minims.

Note.—Strophanthus seeds are obtained from one or more species of *Strophanthus* growing in Eastern Africa, and are usually referred to *Strophanthus Kombé* Oliver.

277. Oxymel Scillæ. *N. F.*

Oxymel of Squill.

Vinegar of Squill,	5 parts.
Honey,	10 parts.

Mix them in a tared porcelain capsule or enamelled iron vessel, and apply the heat of a water-bath until the mixture has been reduced to the weight of *ten* (10) *parts*. Then strain, allow it to cool, and transfer it to bottles, which should be well corked.

Note.—This very old preparation differs but slightly in proportions from that officinal under the same name in the British Pharmacopœia.

Hooper's Pills.

Powdered Ginger,	60 gr.
Powdered Canella,	60 gr.
Extract of Black Hellebore,	120 gr.
Myrrh,	120 gr.
Soap,	120 gr.
Dried Sulphate of Iron,	180 gr.
Aloes,	1 oz. (troy).

Beat them well together into a mass with syrup or water, and divide into pills each containing 2½ gr.

Syrup of Gillenia.

Gillenia,	1 oz. (troy).
Sugar,	15 oz. (troy).
Diluted Alcohol,	8 fl. oz.
Water,	5 fl. oz.

Reduce the Gillenia to a coarse powder, percolate with Diluted Alcohol until 8 fl. oz. are obtained, evaporate to 3 fl. oz., filter, and add sufficient Water to make the liquid measure 8 fl. oz.; then add the Sugar, and dissolve by a gentle heat.

Worm Tea.

Spigelia,	240 gr.
Manna,	240 gr.
Senna,	120 gr.
Fennel,	60 gr.

Contuse the Spigelia and mix it with the other ingredients; infuse in 16 fl. oz. of Boiling Water. Give a child, two years old or upwards, half a teacupful, warm, morning, noon, and night, before eating.

Trochisci Santonini. *U. S.* 1870.

TROCHES OF SANTONIN.

Santonin, in fine powder,	240 gr.
Sugar, in fine powder,	18 oz. (troy).
Tragacanth, in fine powder,	240 gr.
Orange Flower Water, a sufficient quantity.	

Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into 480 troches.

CATHARTIC DRUGS.

Zimmerman's Decoction.

Rhubarb,	80 gr.
Potassium Bitartrate,	240 gr.
Barley,	240 gr.
Water,	16 fl. oz.

Boil for fifteen or twenty minutes, strain, and add enough simple syrup or sugar to sweeten the decoction.

Tamarind Electuary.

(Fuller's.)

Sugar,	800 gr.
Manna,	1½ oz. (troy).
Tamarind,	210 gr.
Potassium Bitartrate,	80 gr.
Powdered Senna,	120 gr.
Boiling Water,	8 fl. oz.

Dissolve the Sugar and Manna in the Boiling Water, and filter, then add the other ingredients.

Aperient Pills.

(Dr. Mitchell's.)

Powdered Aloes,	24 gr.
Powdered Rhubarb,	48 gr.
Mild Chloride of Mercury,	4 gr.
Antimony and Potassium Tartrate,	2 gr.

Make into a mass and divide into 24 pills.

Tinctura Rhei et Sennæ. *U. S.* 1870.

TINCTURE OF RHUBARB AND SENNA.

(Warner's Gout Cordial.)

Rhubarb,	1 oz. (troy).
Senna,	120 gr.
Coriander, Fennel, of each,	60 gr.
Glycyrrhiza,	80 gr.
Raisins, deprived of their seeds,	6 oz. (troy).
Diluted Alcohol,	48 fl. oz.

Macerate for seven days, express, and filter through paper.

261. Mistura Rhei Composita. *N. F.*

Compound Mixture of Rhubarb.

Squibb's Rhubarb Mixture.

Fluid Extract of Rhubarb,	86 min.
Fluid Extract of Ipecac,	16 min.
Bicarbonate of Sodium,	172 gr.
Glycerin,	4 fl. oz.
Peppermint Water, enough to make	16 fl. oz.

Dissolve the Bicarbonate of Sodium in about *eight* (8) *fluidounces* of Peppermint Water, then add the Fluid Extracts and Glycerin, and, lastly, enough Peppermint Water to make *sixteen* (16) *fluidounces.*

411. Tinctura Rhei Aquosa. *N. F.*

Aqueous Tincture of Rhubarb.

1. Rhubarb (cut into thin slices and carefully freed from any adhering fine powder),	720 gr.
Borate of Sodium,	72 gr.
Carbonate of Potassium,	72 gr.
Cinnamon Water,	2 fl. oz.
Alcohol,	1¾ fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Borate of Sodium and the Carbonate of Potassium in *twelve* (12) *fluidounces* of Water, and macerate in this solution, during twenty-four hours, the Rhubarb. Then strain it through muslin, heat the strained liquid to boiling, add the Cinnamon Water and Alcohol, stir it well, and filter, while warm, in a covered funnel. To the cold filtrate add enough Water to make the product measure *sixteen* (16) *fluidounces.*

Each fluidrachm represents about 5⅝ grains of Rhubarb.

Note.—The product is practically identical with that obtained by the process of the Germ. Pharm., in which this preparation is officinal. It is liable to deteriorate when kept too long, and should not be prepared in larger quantity than may be consumed within a short time.

When this preparation is required for immediate use, and it is not otherwise obtainable, it may be prepared in the following manner:

2. Fluid Extract of Rhubarb,	720 min.
Borate of Sodium,	72 gr.
Carbonate of Potassium,	72 gr.
Cinnamon Water,	2 fl. oz.
Alcohol,	1¾ fl. oz.
Water, enough to make	16 fl. oz.

Dissolve the Borate of Sodium and the Carbonate of Potassium in about *eight* (8) *fluidounces* of Water. Add the Cinnamon Water, Alcohol, and Fluid Extract of Rhubarb, and, lastly, enough Water to make the product measure *sixteen* (16) *fluidounces*. Filter, if necessary.

412. Tinctura Rhei et Gentianæ. *N. F.*

Tincture of Rhubarb and Gentian.

1. Rhubarb,	512 gr.
Gentian,	128 gr.
Diluted Alcohol, enough to make	16 fl. oz.

Reduce the solids to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with Diluted Alcohol, until *sixteen* (16) *fluidounces* of percolate are obtained.

Each fluidrachm represents 4 grains of Rhubarb and 1 grain of Gentian.

Note.—When this preparation is required for immediate use, and it is not otherwise obtainable, it may be prepared in the following manner:

2. Fluid Extract of Rhubarb,	512 min.
Fluid Extract of Gentian,	128 min.
Diluted Alcohol, enough to make	16 fl. oz.

Mix the Fluid Extracts with enough Diluted Alcohol to make *sixteen* (16) *fluidounces*, and filter.

413. Tinctura Rhei Vinosa. *N. F.*

Vinous Tincture of Rhubarb.

Fluid Extract of Rhubarb,	600 min.
Fluid Extract of Bitter Orange Peel,	150 min.
Tincture of Cardamom,	600 min.
Sugar,	2 tr. oz.
Sherry Wine, enough to make	16 fl. oz.

Mix the Fluid Extracts and the Tincture with *eight* (8) *fluidounces* of Sherry Wine. In this dissolve the Sugar by agitation, then add enough Sherry Wine to make *sixteen* (16) *fluidounces*, and filter.

Note.—This preparation corresponds, in strength, to that which is officinal in the Germ. Pharm.

166. Extractum Rhei Fluidum Aromaticum. *N. F.*

Aromatic Fluid Extract of Rhubarb.

Rhubarb,	12 tr. oz.
Cinnamon,	2¼ tr. oz.
Cloves,	2¼ tr. oz.
Nutmeg,	1½ tr. oz.

Reduce the drugs to a moderately coarse (No. 40) powder, and prepare a Fluid Extract with diluted alcohol.

Note.—If 1 fl. oz. of this preparation is mixed with 15 fl. oz. of syrup, the product will be practically identical with the officinal Syrupus Rhei Aromaticus.

Compound Powder of Senna.

Powdered Senna,	2 oz. (troy).
Potassium Bitartrate,	2 oz. (troy).
Powdered Scammony,	240 gr.
Powdered Ginger,	120 gr.

Mix. Dose, 20 to 30 grains.

Chelsea Pensioner.

Rhubarb,	120 gr.
Powdered Guaiac,	60 gr.
Potassium Bitartrate,	1 oz. (troy).
Sulphur,	2 oz. (troy).
Powdered Nutmeg,	60 gr.
Honey,	10 fl. oz.

Make into a confection.

40. Elixir Catharticum Compositum. *N. F.*

Compound Cathartic Elixir.

Fluid Extract of Senna,	2 fl. oz.
Fluid Extract of Podophyllum,	1 fl. oz.
Fluid Extract of Leptandra,	360 min.
Fluid Extract of Jalap,	360 min.
Tartrate of Potassium and Sodium,	2 tr. oz.
Bicarbonate of Sodium,	120 gr.
Compound Elixir of Taraxacum,	4 fl. oz.
Elixir of Glycyrrhiza, enough to make	16 fl. oz.

Mix the liquids, add the salts, and dissolve them by agitation.

The product should not be filtered, and should be shaken up whenever any of it is dispensed.

The average dose for an adult is 2 fluidrachms.

66. Elixir Frangulæ. *N. F.*

Elixir of Frangula.

Elixir of Buckthorn.

Fluid Extract of Frangula (U. S. P.),	4 fl. oz.
Alcohol,	1 fl. oz.
Compound Elixir of Taraxacum,	4 fl. oz.
Aromatic Elixir,	7 fl. oz.

Mix them, allow the mixture to stand during forty-eight hours, if convenient, and filter.

Each fluidrachm represents 15 grains of Frangula.

95. Elixir Rhamni Purshianæ. *N. F.*

Elixir of Rhamnus Purshiana.

Elixir of Cascara Sagrada.

Fluid Extract of Rhamnus Purshiana,	4 fl. oz.
Elixir of Glycyrrhiza,	4 fl. oz.
Compound Elixir of Taraxacum,	8 fl. oz.

Mix them. Allow the mixture to stand a few days, if convenient, and filter.

Each fluidrachm represents 15 grains of Rhamnus Purshiana.

96. Elixir Rhamni Purshianæ Compositum. *N. F.*

Compound Elixir of Rhamnus Purshiana.

Compound Elixir of Cascara Sagrada. Elixir Laxativum; Elixir Purgans; Laxative Elixir.

Fluid Extract of Rhamnus Purshiana,	2 fl. oz.
Fluid Extract of Senna,	1½ fl. oz.
Fluid Extract of Juglans,	1 fl. oz.
Fluid Extract of Glycyrrhiza,	½ fl. oz.
Compound Tincture of Cardamom,	½ fl. oz.
Aromatic Spirit,	2 fl. oz.
Syrup,	6 fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Mix the Fluid Extracts with the Compound Tincture of Cardamom and the Aromatic Spirit; then add the Syrup, and, lastly, enough Water to make *sixteen* (16) *fluidounces.* Incorporate the Purified Talcum thoroughly with the mixture, and filter.

The average dose for an adult of this preparation is 1 *to* 2 *teaspoonfuls.*

381. Syrupus Sennæ Aromaticus. *N. F.*

Aromatic Syrup of Senna.

Senna,	2 tr. oz.
Jalap,	384 gr.
Rhubarb,	128 gr.
Cinnamon,	80 gr.
Cloves,	80 gr.
Nutmeg,	15 gr.
Oil of Lemon,	10 min.
Sugar,	12 tr. oz.
Diluted Alcohol, enough to make	16 fl. oz.

Reduce the drugs to a moderately fine (No. 50) powder, add to it the Oil of Lemon, and percolate it, in the usual manner, with Diluted Alcohol. Remove the first *eight* (8) *fluidounces* of the percolate, and dissolve in this the Sugar, with the aid of a gentle heat, if necessary, but avoiding loss of alcohol by evaporation. Allow the solution to cool, collect a further portion of percolate, and add it to the Syrup, so as to make *sixteen* (16) *fluidounces.*

Each fluidrachm represents 7½ *grains of Senna,* 3 *grains of Jalap, and* 1 *grain of Rhubarb, with aromatics.*

382. Syrupus Sennæ Compositus. *N. F.*

Compound Syrup of Senna.

Fluid Extract of Senna,	1024 min.
Fluid Extract of Rhubarb,	256 min.
Fluid Extract of Frangula,	256 min.
Oil of Gaultheria,	30 min.
Alcohol,	1 fl. oz.
Syrup, enough to make	16 fl. oz.

Dissolve the Oil of Gaultheria in the Alcohol, and add this to the mixed Fluid Extracts. Then add enough Syrup to make *sixteen* (16) *fluidounces,* and mix by agitation.

Each fluidrachm represents 8 *grains of Senna,* 2 *grains of Rhubarb, and* 2 *grains of Frangula.*

97. Elixir Rhei. *N. F.*

Elixir of Rhubarb.

Sweet Tincture of Rhubarb (U. S. P.),	8 fl. oz.
Deodorized Alcohol,	1 fl. oz.
Water,	3 fl. oz.
Glycerin,	2 fl. oz.
Syrup,	2 fl. oz.

Mix them, and filter.

Each fluidrachm represents about 2½ *grains of Rhubarb.*

98. Elixir Rhei et Magnesii Acetatis. *N. F.*

Elixir of Rhubarb and Acetate of Magnesium.

Elixir Rhei et Magnesiæ. Elixir of Rhubarb and Magnesia.

Magnesia, calcined,	144 gr.
Acetic Acid (U. S. P.),	a sufficient quantity.
Fluid Extract of Rhubarb,	2 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Magnesia in *two and one-half* (2½) *fluidounces* of Acetic Acid, with the aid of a gentle heat, adding, if necessary, a little more Acetic Acid, drop by drop, until the solution is neutral to test-paper. Then add the Fluid Extract and enough Aromatic Elixir to make *sixteen* (16) *fluidounces,* and filter.

Each fluidrachm represents about 4 *grains of Acetate of Magnesium and* 7½ *grains of Rhubarb.*

333. Species Laxantes. *N. F.*

Laxative Species.

St. Germain Tea (*Germ. Pharm.*).

Senna, cut,	16 parts.
Elder Flowers,	10 parts.
Fennel, bruised,	5 parts.
Anise, bruised,	5 parts.
Bitartrate of Potassium, in fine powder,	4 parts.

Moisten the Senna with a small quantity of water; then sprinkle over it, as uniformly as possible, the Bitartrate of Potassium. When it has become dry, mix it lightly and uniformly with the other ingredients.

320. Pulvis Rhei et Magnesiæ Anisatis. *N. F.*

Anisated Powder of Rhubarb and Magnesia.

Compound Anise Powder.

Rhubarb, in fine powder,	1 tr. oz.
Heavy Magnesia, calcined,	2 tr. oz.
Oil of Anise,	110 min.
Alcohol,	160 min.

Mix the powders, add the Oil of Anise, previously dissolved in the Alcohol, and triturate until a uniform mixture results.

402. Tinctura Jalapæ. *N. F.*

Tincture of Jalap.

Jalap, in fine powder,	8 tr oz.
Alcohol,	
Water, each, enough to make	16 fl. oz

Mix *two* (2) *volumes* of Alcohol with *one* (1) *volume* of Water, percolate the Jalap with this mixture, in the usual manner, until *sixteen* (16) *fluidounces* of Tincture are obtained.

Note.—This preparation was officinal in the U. S. P. of 1870.

403. Tinctura Jalapæ Composita. *N. F.*

Compound Tincture of Jalap.

Jalap, in fine powder, 2 tr. oz.
Scammony, in powder, ½ tr. oz.
Alcohol,
Water, each, enough to make 16 fl. oz.

Mix *two* (2) *volumes* of Alcohol with *one* (1) *volume* of Water. Mix the powders with half their weight of sand; moisten the mixture with a sufficient quantity of the menstruum, pack it in a percolator, and percolate it with the menstruum, in the usual manner, until *sixteen* (16) *fluidounces* of Tincture are obtained.

378. Syrupus Rhamni Catharticæ. *N. F.*

Syrup of Rhamnus Cathartica.

Syrup of Buckthorn Berries. Syrupus Spinæ Cervinæ.

Sugar, 18 tr. oz.
Fermented Juice of Buckthorn Berries, enough to make 16 fl. oz.

Dissolve the Sugar in *seven* (7) *fluidounces* of the Juice, with the aid of a gentle heat, allow the Syrup to cool, then add enough of the Juice to make *sixteen* (16) *fluidounces*, and strain, if necessary.

Note.—This preparation is practically identical with that officinal in the Germ. Pharm. The species of Buckthorn to be used is the *Rhamnus cathartica* Linné, native of Europe, and naturalized, to some extent, in the U. S. If the fresh berries cannot be obtained, the imported fermented juice may be used in preparing the Syrup.

Liver Pills.

(Dr. Chapman.)

Powdered Rhubarb, 60 gr.
Powdered Ipecac, 10 gr.
Powdered Acacia, sufficient.
Oil of Caraway, 10 min.

Mix, and make into 20 pills.

Purgative Tincture.

(Dobell's.)

Resin of Podophyllum, 8 gr.
Tincture of Ginger, 5 fl. dr.
Alcohol, 8 fl. dr.

Mix. Dose, a teaspoonful at night, when lying down.

Tinctura Jalapæ. *U. S.* 1870. TINCTURE OF JALAP.

Jalap, in fine powder, 6 oz. (troy).
Alcohol,
Water, each, a sufficient quantity.

Mix two measures of Alcohol with one of Water; then moisten the powder with 2 fl oz. of the mixture; pack it moderately in a cylindrical percolator, and gradually pour the mixture upon it until 32 fl. oz. of tincture are obtained.

Compound Tincture of Jalap.

(TINCTURA PURGANS.)

Jalap, 1 oz. (troy).
Turpeth Root, 60 gr.
Scammony, 120 gr.
Alcohol (60 per cent.), 12 fl. oz.

Macerate for ten days, express, and filter. Dose, 1 to 4 tablespoonfuls. Known in France as *Eau-de-Vie Allemande*, also *Lavolley's Purgative Elixir.* Sweetened with Sugar it is the *Elixir Antiglaireux de Guillie.*

Laxative Confection.

Potassium Bitartrate, 240 gr.
Powdered Jalap, 240 gr.
Confection of Senna, 1 oz. (troy).

Make into a mass, using Syrup of Ginger if too hard. Dose, a piece the size of a marble three times daily.

23. Decoctum Aloes Compositum. *N. F.*

Compound Decoction of Aloes.

Aqueous Extract of Aloes, 120 gr.
Myrrh, 90 gr.
Saffron, 90 gr.
Carbonate of Potassium, 60 gr.
Extract of Glycyrrhiza, in powder, 1 tr. oz.
Compound Tincture of Cardamom, 8 fl. oz.
Water, enough to make 30 fl. oz.

Reduce the Myrrh and Extract of Aloes to a coarse powder, mix this with the Carbonate of Potassium and Extract of Glycyrrhiza in a suitable covered vessel, and pour on *twenty* (20) *fluidounces* of Water; boil for five minutes, and add the Saffron. When cool, add the Compound Tincture of Cardamom, and allow the mixture to macerate for two hours; then filter through flannel, and add enough Water to make the product measure *thirty* (30) *fluidounces.*

This preparation should be freshly made when wanted for use.

168. Extractum Sennæ Fluidum Deodoratum. *N. F.*

Deodorized Fluid Extract of Senna.

Senna, in No. 60 powder, 16 tr. oz.
Alcohol,
Water, each, a sufficient quantity.

Moisten the Senna with *six* (6) *fluidounces* of Alcohol, pack it firmly in a percolator, and percolate it with Alcohol until it is practically exhausted by this menstruum. The alcoholic percolate thus obtained is rejected, and the Alcohol may be recovered therefrom by distillation Then take out the moist powder, dry it, and prepare a Fluid Extract with a menstruum of Alcohol, 1 volume, and Water 1 volume.

Mettauer's Aperient.

Aloes (in coarse powder),	300 gr.
Sodium Bicarbonate,	600 gr.
Fluid Extract of Valerian,	1 fl. oz.
Compound Tincture of Lavender,	1 fl. oz.
Water,	16 fl. oz.

Mix. Macerate for seven days, and filter. Dose, a tablespoonful.

Elixir Clauderi.

Potassium Carbonate,	240 gr.
Aloes,	60 gr.
Guaiac,	60 gr.
Myrrh,	60 gr.
Saffron,	60 gr.
Rhubarb,	60 gr.
Water,	9 fl. oz.

Macerate a few days, and decant. Dose, a tablespoonful.

Compound Syrup of Juglans.
(SYRUPUS ANTIRRHACHITICUS.)
(Vanier's.)

Extract of Walnut Leaves,	152 gr.
Extract of Cinchona,	75 gr.
Potassium Iodide,	40 gr.
Anise Oil Sugar,	115 gr.
Alcohol,	2½ fl. dr.
White Wine,	4 fl. dr.
Syrup,	12 fl. oz.

Dose, for small children, a teaspoonful four to five times a day; for older children, half a tablespoonful. Vanier's syrup is said to contain, in addition to the above, 5 per cent. of Cod-Liver Oil.

Anderson's Scots Pills.

Aloes,	1 oz. (troy).
Soap,	80 gr.
Colocynth,	20 gr.
Gamboge,	20 gr.
Oil of Anise,	10 min.

Let the Aloes, Colocynth, and Gamboge be reduced to a very fine powder; then beat them and Soap with Water into a mass of a proper consistence to divide into pills each containing 3 gr.

Pulvis Aloës et Canellæ. *U. S.* 1870.
POWDER OF ALOES AND CANELLA (HIERA PICRA).

Socotrine Aloes, in fine powder,	6 oz. (troy).
Canella, in fine powder,	1½ oz. (troy).

Rub them together until they are thoroughly mixed.

283. Pilulæ ad Prandium. *N. F.*
Dinner Pills.

1. When "Dinner Pills," under this or some other equivalent name, are prescribed without further specification, it is recommended that the *Pilulæ Aloes et Masticheæ* of the U. S. P., also called Lady Webster's Dinner Pills, be dispensed.

Note.—Of other combinations, bearing similar names, or used for similar purposes, the following appear to be those most commonly in use:

2. *Chapman's Dinner Pill.*

Each pill contains:

Aloes,	1½ gr.
Mastic,	1½ gr.
Ipecac, in fine powder,	1 gr.
Oil of Fennel, about	¼ min.

3. *Cole's Dinner Pill.*

Each pill contains:

Aloes,	1½ gr.
Mass of Mercury,	1½ gr.
Jalap, in fine powder,	1½ gr.
Tartrate of Antimony and Potassium,	1/16 gr.

4. *Hall's Dinner Pill.*

Each pill contains:

Aloes,	1 gr.
Extract of Glycyrrhiza,	1 gr.
Soap, in powder,	1 gr.
Molasses,	1 gr.

293. Pilulæ Colocynthidis et Hyoscyami. *N. F.*
Pills of Colocynth and Hyoscyamus.

Each pill contains:

Extract of Colocynth,	1/9 gr.
Aloes,	1⅓ gr.
Resin of Scammony,	1⅓ gr.
Oil of Cloves,	⅙ min.
Extract of Hyoscyamus,	1⅓ gr.

Note.—The *Pilula Colocynthidis et Hyoscyami* of the Brit. Pharm. is directed to be made by mixing 2 parts of Compound Pill of Colocynth (see No. 292) with 1 part of Extract of Hyoscyamus, and is directed to be kept as a pill-mass, to be made into pills of such weight as may be directed. When such specification is omitted, it is recommended to dispense pills containing the quantities above directed.

292. Pilulæ Colocynthidis Compositæ. *N. F.*
Compound Pills of Colocynth.
Pilulæ Cocciæ. Cochia Pills.

Each pill contains:

Extract of Colocynth,	⅙ gr.
Aloes,	2 gr.
Resin of Scammony,	2 gr.
Oil of Cloves,	¼ min.

Note.—The *Pilula Colocynthidis Composita* of the Brit. Pharm., for which the above is an equivalent, is prepared with Colocynth Pulp, and contains Sulphate of Potassium, which was originally added as an aid to reduce the ingredients to powder. With the use of Extract of Colocynth this becomes unnecessary.

The Brit. Pharm. directs the above to be kept as a pill-mass, to be made into pills of such weight as may be prescribed. When such specification is omitted, it is recommended to dispense pills containing the quantities above directed.

284. Pilulæ Aloes et Podophylli Compositæ. *N. F.*
Compound Pills of Aloes and Podophyllum.
Janeway's Pills.

Each pill contains:

Aloes,	1 gr.
Resin of Podophyllum,	¼ gr.
Alcoholic Extract of Belladonna,	¼ gr.
Extract of Nux Vomica,	¼ gr.

287. Pilulæ Aloini, Strychninæ, et Belladonnæ Compositæ. *N. F.*

Compound Pills of Aloin, Strychnine, and Belladonna.

Each pill contains:

Aloin,	1/5 gr.
Strychnine, alkaloid,	1/60 gr.
Alcoholic Extract of Belladonna,	1/8 gr.
Extract of Rhamnus Purshiana,	1/2 gr.

Note.—If Extract of Rhamnus Purshiana is not available, take Fluid Extract of Rhamnus Purshiana, prepared without Glycerin, and evaporate it on a water-bath, to a pilular consistence.

These pills are also prepared with double the amount of Strychnine. It is recommended that the stronger pills be dispensed only when specially demanded.

286. Pilulæ Aloini, Strychninæ, et Belladonnæ. *N. F.*

Pills of Aloin, Strychnine, and Belladonna.

Each pill contains:

Aloin,	1/5 gr.
Strychnine, alkaloid,	1/120 gr.
Alcoholic Extract of Belladonna,	1/8 gr.

Note.—These pills are also prepared with double the amount of Strychnine. It is recommended that the stronger pills be dispensed only when specially demanded.

285. Pilulæ Aloini Compositæ. *N. F.*

Compound Pills of Aloin.

Each pill contains:

Aloin,	1/4 gr.
Resin of Podophyllum,	1/8 gr.
Extract of Belladonna,	1/4 gr.

301. Pilulæ Podophylli, Belladonnæ, et Capsici. *N. F.*

Pills of Podophyllum, Belladonna, and Capsicum.

Squibb's Podophyllum Pills.

Each pill contains:

Resin of Podophyllum,	1/4 gr.
Alcoholic Extract of Belladonna,	1/8 gr.
Capsicum, in moderately fine powder,	1/2 gr.
Sugar of Milk, in fine powder,	1 gr.
Acacia, in fine powder,	1/4 gr.
Glycerin,	
Syrup,	each, a sufficient quantity.

297. Pilulæ Laxativæ Post Partum. *N. F.*

Laxative Pills after Confinement.

Barker's Post-Partum Pills.

Each pill contains:

Compound Extract of Colocynth,	1 2/3 gr.
Aloes,	5/6 gr.
Extract of Nux Vomica,	5/12 gr.
Resin of Podophyllum,	1/12 gr.
Ipecac, in fine powder,	1/12 gr.
Extract of Hyoscyamus,	1 1/4 gr.

Note.—This is the formula generally employed by Dr. Fordyce Barker, except where special circumstances render modification necessary. The formula usually quoted in manufacturers' lists and some formularies is not correct.

291. Pilulæ Catharticæ Vegetabiles. *N. F.*

Vegetable Cathartic Pills.

"Improved" Vegetable Cathartic Pills.

Each pill contains:

Compound Extract of Colocynth,	1 gr.
Resin of Podophyllum,	1/4 gr.
Extract of Leptandra,	1/4 gr.
Abstract of Jalap, in fine powder,	1/2 gr.
Extract of Hyoscyamus,	1/4 gr.
Extract of Gentian,	1/4 gr.
Oil of Peppermint,	1/8 min.

Note.—Extract of Leptandra (U. S. P.) is preferable to the so-called Leptandrin, or Resin of Leptandra, as this is of very uncertain and varying composition.

294. Pilulæ Colocynthidis et Podophylli. *N. F.*

Pills of Colocynth and Podophyllum.

Each pill contains:

Compound Extract of Colocynth,	2 1/4 gr.
Resin of Podophyllum,	1/4 gr.

303. Pilulæ Triplices. *N. F.*

Triplex Pills.

Pilula Triplex.

Each pill contains:

1. Aloes,	2 gr.
Mass of Mercury,	1 gr.
Resin of Podophyllum,	1/4 gr.

Note.—When *Pilula Triplex*, under this name or some equivalent, is prescribed without further specification, it is recommended that the above preparation be dispensed. A formula devised by Dr. John W. Francis is also in use:

2. *Francis's Triplex Pill.*

Aloes,	[illegible] gr.
Scammony,	[illegible] gr.
Mass of Mercury,	[illegible] gr.
Croton Oil,	[illegible] min.
Oil of Caraway,	1/4 min.
Tincture of Aloes and Myrrh,	a sufficient quantity.

Knight's Pills.

Powdered Aloes,	54 gr.
Powdered Scammony,	27 gr.
Powdered Gamboge,	9 gr.

Mix, and make into 20 pills.

Pills of Aloin and Podophyllin.

Aloin,	24 gr.
Podophyllin,	12 gr.
Oleoresin of Ginger,	4 min.

Triturate the solid ingredients into a uniform powder, add the Oleoresin, make a mass, and divide into 24 pills. Dose, 1 to 3 pills.

Barker's Pills.

Compound Extract of Colocynth,	20 gr.
Extract of Hyoscyamus,	15 gr.
Aloes,	10 gr.
Extract of Nux Vomica,	5 gr.
Podophyllum,	1 gr.
Powdered Ipecac,	1 gr.

Mix, and make into 12 pills.

Marshall's Pills.

Compound Extract of Colocynth,		
Mass of Mercury,		
Powdered Aloes,		
Powdered Soap,		
Powdered Rhubarb,	of each,	60 gr.

Make into 60 pills.

Boisragon Pills.

(Dr. Hewson's formula.)

Mild Chloride of Mercury,	12 gr.
Powdered Scammony,	12 gr.
Compound Extract of Colocynth,	40 gr.
Oil of Caraway,	4 min.
Aloes,	8 gr.

Mix, and make into 14 pills.

Cobb's Pills.

Extract of Hyoscyamus,	80 gr.
Extract of Conium,	80 gr.
Extract of Colocynth,	40 gr.
Extract of Nux Vomica,	4 gr.

Mix, and divide into 80 pills.

Laxative Pills.

(Cole's.)

Compound Extract of Colocynth,	60 gr.
Mild Chloride of Mercury,	20 gr.
Resin of Podophyllum,	2 gr.

Mix, and make into 20 pills.

ASTRINGENT DRUGS.

Astringent Tincture.

(Aromatic Tincture of Galls.)

(Gilbert's.)

Nutgall,	16 oz. (av.).
Oil of Citron,	80 min.
Oil of Bergamot,	80 min.
Oil of Lemon,	80 min.
Oil of Thyme,	8 min.
Oil of Lavender,	8 min.
Oil of Rosemary,	8 min.
Tincture of Benzoin,	1 fl. dr.
Alcohol (90 per cent.), sufficient.	

Exhaust the Gall by percolation with Alcohol, distil off the Alcohol, and evaporate to 8 fl. oz.; redissolve this extract in 8 fl. oz. of Alcohol, add the Oils, and filter.

311. Pulvis Catechu Compositus. ***N. F.***

Compound Powder of Catechu.

Catechu, in fine powder,	4 parts.
Kino, in fine powder,	2 parts.
Krameria, in fine powder,	2 parts.
Cinnamon, in fine powder,	1 part.
Nutmeg, in fine powder,	1 part.

Mix them intimately, pass the powder through a fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle.

Note.—This preparation is officinal in the Brit. Pharm.

Aromatic Syrup of Galls.

Nutgall,	240 gr.
Cinnamon,	120 gr.
Nutmeg,	120 gr.
Glycerin,	6 fl. dr.
Syrup,	6 fl. oz.
Brandy, sufficient.	

Mix the powders, and, having moistened the mixture with a sufficient quantity of Brandy, pack it firmly in a small conical glass percolator, and gradually pour Brandy upon it until it commences to drop; then insert a cork tightly in the lower orifice of the percolator, and let it stand twenty-four hours; then withdraw the cork, and continue the percolation with Brandy until 6 fl. oz. of tincture are obtained. Mix this with the Glycerin, and evaporate by a water-bath, at a temperature not exceeding 125° F., to 3 fl. oz., filter, and thoroughly mix with the Syrup.

191. Infusum Rosæ Compositum. ***N. F.***

Compound Infusion of Rose.

Red Rose,	96 gr.
Diluted Sulphuric Acid,	70 min.
Sugar,	800 gr.
Boiling Water,	16 fl. oz.

Pour the Boiling Water upon the Rose in a glass or porcelain vessel, add the Acid, cover the vessel, and macerate for an hour. Then dissolve the Sugar in the liquid, and strain.

6. Aqua Hamamelidis. ***N. F.***

Hamamelis Water.

Witchhazel Water. Witchhazel Extract.

Hamamelis, shoots and twigs,	10 pounds.
Water,	20 pints.
Alcohol,	1½ pints.

Place the Hamamelis in a still, add the Water and Alcohol, and allow the mixture to macerate during twenty-four hours. Distil *ten* (10) *pints* by applying direct heat, or, preferably, by means of steam.

Note.—This preparation should be made only from the fresh young twigs of Hamamelis, which are collected for this purpose, preferably, when the plant is in flower, in the late autumn of the year.

99. Elixir Rubi Compositum. ***N. F.***

Compound Elixir of Blackberry.

Blackberry Root,	2 tr. oz.
Galls,	2 tr. oz.
Cinnamon, Saigon,	2 tr. oz.
Cloves,	½ tr. oz.
Mace,	¼ tr. oz.
Ginger,	¼ tr. oz.
Diluted Alcohol, a sufficient quantity.	
Blackberry Juice, recently expressed,	8 pints.
Syrup,	8 pints.

Reduce the solids to a moderately coarse (No. 40) powder, moisten it with Diluted Alcohol, and percolate it with this menstruum in the usual manner, until *two* (2) *pints* of percolate are obtained. To this add the Blackberry Juice and Syrup, and mix thoroughly.

22. Cordiale Rubi Fructus. *N. F.*

Blackberry Cordial.

Blackberry Juice,	3 pints.
Cinnamon, in coarse powder,	2 tr. oz.
Cloves, in coarse powder,	½ tr. oz.
Nutmeg, in coarse powder,	½ tr. oz.
Diluted Alcohol,	2 pints.
Syrup,	3 pints.

Percolate the powdered spices with Diluted Alcohol to obtain *two* (2) *pints* of tincture, and add to this the *three* (3) *pints* of Blackberry Juice. Then add *one hundred and twenty* (120) *grains* of Purified Talcum. Set the mixture aside for twelve hours, or longer, if convenient, occasionally shaking, and filter. To the filtrate add the Syrup.

Note.—This formula differs in manipulation from that given in the text of the *National Formulary*, but is in accord with the corrected formula given in the *Errata* of the *Formulary*.

379. Syrupus Rubi Aromaticus. *N. F.*

Aromatic Syrup of Blackberry.

Rubus (U. S. P.),	2 tr. oz.
Cinnamon,	120 gr.
Nutmeg,	120 gr.
Cloves,	60 gr.
Allspice,	60 gr.
Diluted Alcohol,	a sufficient quantity.
Sugar,	10 tr. oz.
Blackberry Juice,	a sufficient quantity.

Reduce the Rubus (Blackberry Root) and the Aromatics to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with the Diluted Alcohol, until *four* (4) *fluidounces* of percolate are obtained. To this add *seven* (7) *fluidounces* of Blackberry Juice, and dissolve the Sugar in the liquid by agitation. Lastly, add enough Blackberry Juice to make *sixteen* (16) *fluidounces*.

316. Pulvis Kino Compositus. *N. F.*

Compound Powder of Kino.

Kino, in fine powder,	15 parts.
Powdered Opium,	1 part.
Cinnamon, in fine powder,	4 parts.

Mix them intimately, pass the mixed powder through a moderately fine sieve, and afterwards rub it lightly in a mortar. Keep it in a stoppered bottle.

Every 20 grains of this preparation contain 1 grain of Powdered Opium.

Note.—This preparation is officinal in the Brit. Pharm.

Pavesi's Hæmostatic.

Sulpho-Carbolic Acid,	3 fl. dr.
Benzoic Acid,	37 gr.
Tannic Acid,	37 gr.
Alcohol,	3 fl. dr.
Glycerin,	3 fl. dr.
Rose Water,	3 fl. oz.

The Sulpho-Carbolic Acid is prepared by mixing 1 part Sulphuric Acid and ½ part Carbolic Acid and heating for a few minutes on a water-bath; the Benzoic Acid is dissolved in the Alcohol and Glycerin, the Tannic Acid in the Water, and both mixed.

Hæmostatic Collodion.

(Pavesi's.)

Tannic Acid,	80 gr.
Benzoic Acid,	45 gr.
Carbolic Acid,	158 min.
Collodion,	3½ fl. oz.

Mix and dissolve.

Pile Ointment.

Morphine Acetate,	5 gr.
Tannic Acid,	30 gr.
Solution of Subacetate of Lead,	1 fl. dr.
Ointment,	420 gr.

Incorporate the Solution with the Ointment, then add the other ingredients.

Glyceritum Acidi Tannici. *U. S.* 1870.

Glycerite of Tannic Acid.

Tannic Acid,	1 oz. (troy).
Glycerin,	4 fl. oz.

Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected.

Glyceritum Acidi Gallici. *U. S.* 1870.

Glycerite of Gallic Acid.

Gallic Acid,	2 oz. (troy).
Glycerin,	8 fl. oz.

Rub them together in a mortar, then transfer to a glass or porcelain capsule, and heat gently until the Acid is dissolved.

Infusum Catechu Compositum. *U. S.* 1870.

Compound Infusion Catechu.

Catechu, in fine powder,	240 gr.
Cinnamon, in moderately fine powder,	60 gr.
Boiling Water,	16 fl. oz.

Macerate in a covered vessel, and strain.

Compound Tincture of Kino.

Powdered Opium,	60 gr.
Powdered Kino,	60 gr.
Camphor,	90 gr.
Cloves,	90 gr.
Diluted Alcohol,	16 fl. oz.

Make a tincture by percolation.

404. Tinctura Kino Composita. *N. F.*

Compound Tincture of Kino.

Tincture of Kino,	1½ fl. oz.
Tincture of Opium,	1½ fl. oz.
Spirit of Camphor,	520 min.
Oil of Cloves,	10 min.
Cochineal, in powder,	64 gr.
Aromatic Spirit of Ammonia,	60 min.
Diluted Alcohol, enough to make	16 fl. oz.

Triturate the Cochineal with the Aromatic Spirit of Ammonia, and gradually add *eleven* (11) *fluidounces* of Diluted Alcohol. Then add the two Tinctures, the Spirit of Camphor, and the Oil of Cloves, and filter the mixture through paper. Lastly, pass enough Diluted Alcohol through the filter to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about ½ grain, each, of Kino and of Powdered Opium.

Tannin Nasal Bougies.

Tannic Acid,	31 gr.
Tragacanth,	100 gr.
Althæa,	31 gr.
Glycerin,	100 min.
Distilled Water,	50 min.

Make 4 cuneiform rods three inches long, upon a pill-tile, using powdered Althæa to dust the tile. To be moistened before being introduced into the nose.

Diarrhœa Mixture.

(Dr. Wm. Gould.)

Compound Tincture of Rhubarb,	1 fl. oz.
Tincture of Opium,	4 fl. dr.
Spirit of Camphor,	2 fl. dr.
Water of Ammonia,	1 fl. dr.
Oil of Peppermint,	30 min.

Mix. Dose, a teaspoonful in hot, sweetened water. Repeat as often as necessary till relieved.

Syrup of Pipsissewa.

Fluid Extract of Chimaphila,	4 fl. oz.
Syrup, a sufficient quantity to make	16 fl. oz.

Mix.

DRUGS CONTAINING ALKALOIDS.

197. Linimentum Opii Compositum. *N. F.*

Compound Liniment of Opium.

Canada Liniment.

Tincture of Opium,	1½ fl. oz.
Camphor,	120 gr.
Alcohol,	4 fl. oz.
Oil of Peppermint,	180 min.
Water of Ammonia,	6 fl. oz.
Oil of Turpentine, enough to make	16 fl. oz.

Dissolve the Camphor and the Oil of Peppermint in the Alcohol, then add the Tincture of Opium, Water of Ammonia, and Oil of Turpentine. Shake the mixture whenever any of it is to be dispensed.

Note.—This Liniment will separate a short time after it has been mixed. It may be made somewhat more permanent by adding 180 minims of Tincture of Quillaja (N. F.) to the Water of Ammonia, before adding it to the mixture.

Sun Cholera Mixture.

Tincture of Opium,	
Tincture of Capsicum,	
Tincture of Rhubarb,	
Spirit of Camphor,	
Spirit of Peppermint,	of each, 1 fl. oz.

Mix. Dose, a teaspoonful in water after each evacuation of the bowels.

Compound Tincture of Opium.

(Squibb's Diarrhœa Mixture.)

Tincture of Opium,	1 fl. oz.
Tincture of Capsicum,	1 fl. oz.
Spirit of Camphor,	1 fl. oz.
Purified Chloroform,	3 fl. dr.
Alcohol, sufficient to make	5 fl. oz.

Mix. Dose, from 30 to 60 minims.

255. Mistura Contra Diarrhœam. *N. F.*

1. *Loomis's Diarrhœa Mixture.*

Tincture of Opium,	½ fl. oz.
Tincture of Rhubarb,	½ fl. oz.
Compound Tincture of Catechu (U. S. P.),	1 fl. oz.
Oil of Sassafras,	20 min.
Compound Tincture of Lavender, enough to make	4 fl. oz.

2. *Thielemann's Diarrhœa Mixture.*

Wine of Opium,	1 fl. oz.
Tincture of Valerian,	1½ fl. oz.
Ether,	½ fl. oz.
Oil of Peppermint,	60 min.
Fluid Extract of Ipecac,	15 min.
Alcohol, enough to make	4 fl. oz.

This preparation is practically identical with the *Mixtura Thielemanni* of the Swedish Pharm.

3. *Velpeau's Diarrhœa Mixture.*

Tincture of Opium,
Compound Tincture of Catechu (U. S. P.),
Spirit of Camphor, each, equal volumes.

224. Liquor Morphinæ Citratis. *N. F.*

Solution of Citrate of Morphine.

Morphine (alkaloid),	16 gr.
Citric Acid,	12 gr.
Cochineal,	½ gr.
Alcohol,	60 min.
Distilled Water, enough to make	1 fl. oz.

Triturate the solids with the Alcohol and *seven* (7) *fluidrachms* of Water; filter and pass enough Distilled Water through the filter to make *one* (1) *fluidounce*.

This solution should not be kept on hand, but prepared only when required.

Each fluidrachm contains 2 grains of Morphine in the form of Citrate.

225. Liquor Morphinæ Hypodermicus. N. F.

Hypodermic Solution of Morphine.

Magendie's Solution of Morphine.

Sulphate of Morphine,	16 gr.
Distilled Water, warm,	1 fl. oz.

Dissolve the Sulphate of Morphine in the warm Distilled Water, and filter the solution through a small pellet of absorbent cotton. When the solution is cold, pass a little Distilled Water through the cotton, if necessary, to make the filtrate measure *one* (1) *fluidounce*. Keep the solution in well-stoppered vials, in a dark place.

Note.—Particular care should be taken in dispensing and labelling this solution, so that it may not be mistaken for the so-called United States Solution of Morphine (*Liquor Morphiæ Sulphatis*, U. S. P. 1870), containing only 1 grain of Sulphate of Morphine in each fluidounce, which is still used in some parts of this country.

The development of fungoid growths or micro-organisms in this and similar solutions used hypodermically may be prevented, or at least greatly retarded, by using Chloroform Water instead of plain Distilled Water as a solvent. This should, however, be done only with the knowledge, or by the direction, of the physician.

Another efficient method to preserve such solutions is to sprinkle a little Benzoic Acid on the surface of the absorbent cotton through which the solutions are filtered. Or, about 5 grains of Boric Acid may be added to each fluidounce.

310. Pulvis Anticatarrhalis. N. F.

Catarrh Powder.

Catarrh Snuff.

Hydrochlorate of Morphine,	1 part.
Acacia, in fine powder,	60 parts.
Subnitrate of Bismuth,	180 parts.

Mix them intimately by trituration.

Bateman's Pectoral Drops.

Opium,	120 gr.
Catechu,	120 gr.
Camphor,	120 gr.
Oil of Anise,	30 min.
Caramel,	1½ fl. oz.
Diluted Alcohol,	64 fl. oz.

Digest for ten days.

Jackson's Pectoral Syrup.

Oil of Sassafras,	64 min.
Tincture of Tolu,	8 fl. oz.
Magnesium Carbonate,	2 oz. (troy).
Water,	8 pints.
Sugar,	14 lb. (av.).
Morphine Hydrochlorate,	64 gr.

Rub up the Tincture of Tolu and Oil of Sassafras with the Carbonate, gradually add ½ lb. of the Sugar and then the Water, filter, recovering 8 pints, in which dissolve the remainder of the Sugar. Dissolve the Morphine in 1 fl. oz. of Water, add to the Syrup, and make the measure up to 16 pints.

Godfrey's Cordial.

Tincture of Opium,	8 fl. oz.
Potassium Carbonate,	150 gr.
Oil of Sassafras,	30 min.
Molasses (sugar-house),	82 fl. oz.
Alcohol,	4 fl. oz.
Water,	52 fl. oz.

Dissolve the Potassium Carbonate in the Water, add the Molasses, and heat over a gentle fire till they simmer; remove the scum which rises, and add the Tincture of Opium, Alcohol, and Oil, having previously mixed them together.

Battley's Sedative.

Extract of Opium,	360 gr.
Boiling Water,	7 fl. oz.
Alcohol,	1½ fl. oz.
Cold Water, sufficient to make	10 fl. oz.

Dissolve the Extract in Boiling Water; when cold, add to the solution the Alcohol and enough Water to make 10 fl. oz.; and, lastly, filter through paper. Dose, 5 minims.

Camphorated Dover's Powder.

(Dr. Eli Ives's.)

Potassium Bitartrate,	1 oz. (troy).
Powdered Camphor,	120 gr.
Powdered Ipecac,	60 gr.
Powdered Opium,	60 gr.

Mix, and pass through a fine sieve.

Confectio Opii. U. S. 1870.

CONFECTION OF OPIUM.

Opium, in fine powder,	270 gr.
Aromatic Powder,	6 oz. (troy).
Clarified Honey,	14 oz. (troy).

Rub the Opium with the Aromatic Powder, then add the Honey, and beat the whole together until thoroughly mixed.

269. Olea Infusa. N. F.

Infused Oils.

The Dry Herb, in moderately coarse (No. 40) powder,	100 parts.
Alcohol,	75 parts.
Water of Ammonia,	2 parts.
Lard Oil,	250 parts.
Cotton-Seed Oil,	250 parts.

Moisten the powdered Herb with a sufficient quantity of the Alcohol and Water of Ammonia, previously mixed, then pack it tightly into a stone or enamelled iron vessel of suitable capacity, pour on the remainder of the ammoniated Alcohol, cover it well, and allow the mixture to macerate for twenty-four hours. Then add *sixty* (60) *parts* of the mixed Oils, digest, under frequent agitation, during twelve hours, at a temperature between 50° and 60° C. (122° to 140° F.), transfer the mixture to a strainer, and express strongly. To the residue, returned to

the vessel, add the remainder of the Oils, digest and express in the same manner, and unite the expressed portions.

Note.—This process is a modification of that prescribed by the Germ. Pharm. The alcohol and free ammonia are dissipated during the digestion. Infused Oils are usually prepared only from so-called narcotic plants, but it is known that only a portion of their active constituents is taken up by the oil. The above process is to be used for the preparation of *Oleum Hyoscyami* of the Germ. Pharm., and similar Infused Oils.

276. Oleum Hyoscyami Compositum. *N. F.*

Compound Oil of Hyoscyamus.

Balsamum Tranquillans.

Oil of Absinthe,	8 drops.
Oil of Lavender,	8 drops.
Oil of Rosemary,	8 drops.
Oil of Sage,	8 drops.
Oil of Thyme,	8 drops.
Infused Oil of Hyoscyamus,	5 fl. oz.

Mix them.

Note.—Oil of Absinthe is the volatile oil of *Artemisia Absinthium* Linné (Wormwood), and Oil of Sage is the volatile oil of *Salvia officinalis* Linné. Infused Oil of Hyoscyamus is the *Oleum Hyoscyami* of the Germ. Pharm.; see under No. 269. The *Baume Tranquille* (*Balsamum tranquillans*) of the Codex is a more complex preparation, not identical with the above, but possessing about the same properties.

Asiatic Tincture.

(For cholera.)

Opium,	240 gr.
Camphor,	240 gr.
Capsicum,	240 gr.
Oil of Cloves,	4 fl. dr.
Compound Spirit of Ether,	8 fl. oz.

Macerate from ten to twenty days, or prepare by percolation in a close percolator. Dose, 20 to 60 drops every second, third, or fourth hour in sweetened water.

Tinctura Opii Acetata. *U. S.* 1870.

ACETATED TINCTURE OF OPIUM.

Powdered Opium,	2 oz. (troy).
Distilled Vinegar,	12 fl. oz.
Alcohol,	8 fl. oz.

Macerate for a week, express, and filter.

Liquor Opii Compositus.

COMPOUND SOLUTION OF OPIUM.

(Squibb's.)

Deodorized Solution of Opium,	14 fl. dr.
Alcohol,	18 fl. dr.
Purified Chloroform,	1 fl. dr.
Acetic Ether,	2 fl. dr.

Mix. See Am. Jour. Pharmacy, 1870, p. 47. Dose, 15 to 30 min.

Ferrated Elixir of Calisaya.

Citrate of Iron and Ammonium,	512 gr.
Elixir of Calisaya,	32 fl. oz.

Dissolve.

299. Pilulæ Opii et Camphoræ. *N. F.*

Pills of Opium and Camphor.

	Each pill contains:
Powdered Opium,	1 gr.
Camphor,	2 gr.

300. Pilulæ Opii et Plumbi. *N. F.*

Pills of Opium and Lead.

	Each pill contains:
Powdered Opium,	1 gr.
Acetate of Lead,	1 gr.

Golden Tincture.

Ether,	2 fl. oz.
Tincture of Opium,	2 fl. oz.
Chloroform,	4 fl. dr.
Alcohol,	2 fl. oz.

Mix. Dose, 8 to 20 drops.

Syrup of Morphine.

(SIROP DE MORPHINE. Fr. Codex.)

Morphine Hydrochlorate,	1 gr.
Distilled Water,	20 min.
Syrup, sufficient to make	27 fl. dr.

Mix. A tablespoonful contains about ⅛ gr. Morphine.

Schuyler's Powder.

Morphine Sulphate,	15 gr.
Camphor,	90 gr.
Powdered Ipecac,	90 gr.
Powdered Glycyrrhiza,	1½ oz. (troy).
Sugar,	1½ oz. (troy).

Mix.

Liquor Morphiæ Sulphatis. *U. S.* 1870.

SOLUTION OF SULPHATE OF MORPHIA.

Sulphate of Morphia,	8 gr.
Distilled Water,	8 fl. oz.

Dissolve the Sulphate in the Distilled Water.

Gout Mixture.

(Laville's.)

Quinine Sulphate,	30 gr.
Cinchonine Sulphate,	22 gr.
Extract of Colocynth,	195 gr.
Diluted Alcohol,	3 fl. oz.
Red Wine, sufficient to make	16 fl. oz.

Mix.

Neuralgia Pills.

(Prof. Gross's.)

Quinine Sulphate,	60 gr.
Morphine Sulphate,	1½ gr.
Strychnine,	1 gr.
Arsenious Acid,	1½ gr.
Extract of Aconite,	15 gr.

Mix, and make into 30 pills.

Pills of Chinoidine.

Chinoidine,	60 gr.
Diluted Sulphuric Acid, sufficient	

Soften the Chinoidine with the Acid in the mortar, and divide into 20 pills.

289. Pilulæ Antineuralgicæ. N. F.

Antineuralgic Pills.

1. *Gross's Antineuralgic Pills.*

Each pill contains:

Sulphate of Quinine,	2 gr.
Sulphate of Morphine,	1/16 gr.
Strychnine, alkaloid,	1/16 gr.
Arsenious Acid,	1/16 gr.
Extract of Aconite Leaves (U.S.P. 1870),	½ gr.

Note.—When "Antineuralgic Pills," or "Neuralgia Pills," without other specification, are prescribed, it is recommended that the above preparation be dispensed. Sometimes the Sulphate of Morphine is directed to be omitted.

2. *Brown-Séquard's Antineuralgic* (or *Neuralgia*) *Pills* have the following composition:

Each pill contains:

Extract of Hyoscyamus,	⅕ gr.
Extract of Conium,	⅕ gr.
Extract of Ignatia,	⅕ gr.
Extract of Opium,	⅕ gr.
Extract of Aconite Leaves (U.S.P.1870),	⅕ gr.
Extract of Indian Cannabis,	⅕ gr.
Extract of Stramonium,	⅕ gr.
Alcoholic Extract of Belladonna,	⅕ gr.

Elixir of Calisaya.

Quinine Sulphate,	72 gr.
Cinchonine Sulphate,	24 gr.
Quinidine Sulphate,	20 gr.
Cinchonidine Sulphate,	12 gr.
Elixir of Orange,	128 fl. oz.
Caramel, a sufficient quantity to color.	

Triturate the mixed Sulphates with 1 pint of the Elixir; pour the mixture into a glass flask, and heat in a water-bath until the solution is effected; while still hot, add the remainder of the Elixir and Caramel; when cold, filter.

272. Oleatum Quininæ. N. F.

Oleate of Quinine.

Quinine (U.S. P. 1880) dried at 100° C. (212° F.) until it ceases to lose weight,	25 parts.
Oleic Acid,	75 parts.

Triturate the Quinine with the Oleic Acid, gradually added, then apply a gentle heat, and stir frequently, until the Quinine is dissolved.

The product contains 25 *per cent. of dry Quinine* (*U. S. P.* 1880).

Note.—When the officinal Quinine ($C_{20}H_{24}N_2O_2.3H_2O$) is not available, the quantity corresponding to 25 parts of dry Quinine may be prepared as follows: Take 34 parts of officinal Sulphate of Quinine, dissolve it in 200 parts of Water with the aid of a sufficient quantity of Diluted Sulphuric Acid, then precipitate the Quinine by means of Water of Ammonia, added, under constant stirring, until it is in slight excess. Transfer the magma to a close muslin strainer, previously wetted, allow the liquid to drain off, and wash the precipitate with ice-cold Water until the washings are practically tasteless, but using not more than about 200 parts of Water. Lastly, dry the precipitate.

The theoretical quantity of dry quinine obtainable from 34 parts of the sulphate is 25·27 parts. In practice, approximately 25 parts will be obtained.

302. Pilulæ Quatuor. N. F.

Quatuor Pills.

Pilulæ Ferri et Quininæ Compositæ.

Each pill contains:

Dried Sulphate of Iron,	1 gr.
Sulphate of Quinine,	1 gr.
Aloes,	1 gr.
Extract of Nux Vomica,	½ gr.
Extract of Gentian, a sufficient quantity.	

42. Elixir Cinchonæ. N. F.

Elixir of Cinchona.

Elixir of Calisaya.

Tincture of Cinchona (U. S. P. 1880),	2½ fl. oz.
Aromatic Spirit,	2 fl. oz.
Syrup,	6 fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Mix the liquids, allow the mixture to stand for twenty-four hours or longer, if convenient, then incorporate the Purified Talcum, and filter through a wetted filter, returning the first portions of the filtrate until it runs through clear.

Each fluidounce represents about 14 *grains of Yellow Cinchona.*

Note.—When Elixir of Cinchona is directed in combination with preparations of iron, the *Elixir Cinchonæ Detannatum* should be used in place of the above preparation.

43. Elixir Cinchonæ et Hypophosphitum. N. F.

Elixir of Cinchona and Hypophosphites.

Elixir of Calisaya and Hypophosphites.

Hypophosphite of Calcium,	128 gr.
Hypophosphite of Sodium,	128 gr.
Citric Acid,	80 gr.
Water,	2 fl. oz.
Elixir of Cinchona, enough to make	16 fl. oz.

Dissolve the Hypophosphites and the Citric Acid in the Water, add enough Elixir of Cinchona to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 1 *grain, each, of the Hypophosphites of Calcium and Sodium.*

44. Elixir Cinchonæ Detannatum. N. F.

Detannated Elixir of Cinchona.

Detannated Elixir of Calisaya.

Detannated Tincture of Cinchona,	2½ fl. oz.
Aromatic Spirit,	2 fl. oz.
Syrup,	6 fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Mix the liquids, allow the mixture to stand twenty-four hours or longer, if convenient, then incorporate the Purified Talcum, and filter through a wetted filter, returning the first portions of the filtrate, until it runs through clear.

Each fluidounce represents about 14 grains of Yellow Cinchona.

Note.—This preparation is to be used when *Elixir Cinchonæ* is directed in combination with preparations of *iron*.

When Detannated Elixir of Cinchona is not available, and the preparation, of which it forms a constituent, is required at once, an equivalent quantity of Compound Elixir of Quinine, colored by the addition of 120 minims of Compound Tincture of Cudbear to each pint, may be substituted for it.

45. Elixir Cinchonæ et Ferri. *N. F.*

Elixir of Cinchona and Iron.

Elixir of Calisaya and Iron. Ferrated Elixir of Calisaya.

Phosphate of Iron (U. S. P. 1880), 256 gr.
Water, boiling, 1 fl. oz.
Detannated Elixir of Cinchona, enough to make 16 fl. oz.

Dissolve the Phosphate of Iron in the boiling Water, then add enough Detannated Elixir of Cinchona to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 2 grains of Phosphate of Iron.

46. Elixir Cinchonæ, Ferri, Bismuthi, et Strychninæ. *N. F.*

Elixir of Cinchona, Iron, Bismuth, and Strychnine.

Elixir of Calisaya, Iron, Bismuth, and Strychnine.

Citrate of Bismuth and Ammonium, 128 gr.
Sulphate of Strychnine, 1¼ gr.
Water, hot, a sufficient quantity.
Elixir of Cinchona and Iron, enough to make 16 fl. oz.

Dissolve the Citrate of Bismuth and Ammonium in *one-half* (½) *fluidounce* of hot Water; allow the solution to stand until any undissolved matter has subsided, then decant the clear liquid, and add to the residue enough Water of Ammonia to dissolve it, carefully avoiding an excess. Dissolve the Sulphate of Strychnine in *one* (1) *fluidrachm* of hot Water, and having mixed the two solutions, add enough Elixir of Cinchona and Iron to make *sixteen* (16) *fluidounces*. Let the mixture stand twenty-four hours, if convenient, and filter.

Each fluidrachm contains 1 grain of Citrate of Bismuth and Ammonium, $\frac{1}{100}$ grain of Sulphate of Strychnine, and nearly 2 grains of Phosphate of Iron.

47. Elixir Cinchonæ, Ferri, et Bismuthi. *N. F.*

Elixir of Cinchona, Iron, and Bismuth.

Elixir of Calisaya, Iron, and Bismuth.

Citrate of Bismuth and Ammonium, 128 gr.
Water, hot, ½ fl. oz.
Elixir of Cinchona and Iron, enough to make 16 fl. oz.

Dissolve the Citrate of Bismuth and Ammonium in the hot Water, allow the solution to stand until any undissolved matter has subsided; then decant the clear liquid, and add to the residue enough Water of Ammonia to dissolve it, carefully avoiding an excess. Then mix the solution with enough Elixir of Cinchona and Iron to make *sixteen* (16) *fluidounces*. Let the mixture stand twenty-four hours, if convenient, and filter.

Each fluidrachm contains 1 grain of Citrate of Bismuth and Ammonium and nearly 2 grains of Phosphate of Iron.

48. Elixir Cinchonæ, Ferri, et Calcii Lactophosphatis. *N. F.*

Elixir of Cinchona, Iron, and Lactophosphate of Calcium.

Elixir of Calisaya, Iron, and Lactophosphate of Lime.

Lactate of Calcium, 64 gr.
Phosphoric Acid (50 per cent.), 64 min.
Water of Ammonia, ½ fl. oz.
Citric Acid, 120 gr.
Elixir of Cinchona and Iron, enough to make 16 fl. oz.

Dissolve the Lactate of Calcium in *seven* (7) *fluidounces* of Elixir of Cinchona and Iron, with the aid of the Phosphoric Acid. Then add the Citric Acid, and when this is dissolved, the Water of Ammonia. Finally, add enough Elixir of Cinchona and Iron to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains ½ grain of Lactate of Calcium (or about ¾ grain of so-called Lactophosphate of Calcium) and nearly 2 grains of Phosphate of Iron.

49. Elixir Cinchonæ, Ferri, et Pepsini. *N. F.*

Elixir of Cinchona, Iron, and Pepsin.

Elixir of Calisaya, Iron, and Pepsin.

Pepsin (N. F.), 128 gr.
Hydrochloric Acid, 30 min.
Water, 8 fl. oz.
Elixir of Cinchona and Iron, enough to make 16 fl. oz.

Dissolve the Pepsin in the Water mixed with the Hydrochloric Acid; then add enough Elixir of Cinchona and Iron to

make *sixteen* (16) *fluidounces*. Let the mixture stand a few days, if convenient, and filter.

Each fluidrachm represents 1 grain of Pepsin (N. F.) and about 1¼ grains of Phosphate of Iron.

50. Elixir Cinchonæ, Ferri, et Strychninæ. *N. F.*

Elixir of Cinchona, Iron, and Strychnine.

Elixir of Calisaya, Iron, and Strychnine.

Sulphate of Strychnine,	1¼ gr.
Water,	120 min.
Elixir of Cinchona and Iron, enough to make	16 fl. oz.

Dissolve the Sulphate of Strychnine in the Water, and add enough Elixir of Cinchona and Iron to make *sixteen* (16) *fluidounces*.

Each fluidrachm contains $\frac{1}{100}$ grain of Sulphate of Strychnine and about 2 grains of Phosphate of Iron.

51. Elixir Cinchonæ, Pepsini, et Strychninæ. *N. F.*

Elixir of Cinchona, Pepsin, and Strychnine.

Elixir of Calisaya, Pepsin, and Strychnine.

Sulphate of Quinine,	16 gr.
Sulphate of Cinchonine,	8 gr.
Sulphate of Strychnine,	1¼ gr.
Elixir of Pepsin,	16 fl. oz.

Dissolve the alkaloidal salts in the Elixir, and filter, if necessary.

Each fluidrachm represents small quantities of Cinchona Alkaloids, $\frac{1}{100}$ grain of Sulphate of Strychnine, and 1 grain of Pepsin (N. F.).

92. Elixir Quininæ Compositum. *N. F.*

Compound Elixir of Quinine.

Sulphate of Quinine,	16 gr.
Sulphate of Cinchonidine,	8 gr.
Sulphate of Cinchonine,	8 gr.
Aromatic Elixir,	16 fl. oz

Add the alkaloidal salts to the Aromatic Elixir, and dissolve them by agitation. Finally, filter.

Each fluidounce contains 1 grain of Sulphate of Quinine and ½ grain, each, of the Sulphates of Cinchonidine and Cinchonine.

Note.—This preparation is chiefly intended as a substitute for Elixir of Cinchona in certain cases, when the presence of other constituents of Cinchona is deemed unnecessary, or where the Elixir is intended rather as a vehicle than a medicine.

If it is desired to impart a color to this Elixir, this may be effected by the addition of 120 minims of Compound Tincture of Cudbear to each pint.

93. Elixir Quininæ et Phosphatum Compositum. *N. F.*

Compound Elixir of Quinine and Phosphates.

Sulphate of Quinine,	32 gr.
Phosphate of Iron (U. S. P. 1880),	128 gr.
Citrate of Potassium,	128 gr.
Syrup of Lactophosphate of Calcium,	4 fl. oz.
Water,	½ fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Dissolve the Sulphate of Quinine in *ten* (10) *fluidounces* of Aromatic Elixir, if necessary with the aid of a gentle heat. Dissolve the Phosphate of Iron and the Citrate of Potassium in the Water, and add the solution to that first prepared. Then add the Syrup of Lactophosphate of Calcium, and, lastly, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains ¼ grain of Sulphate of Quinine, 1 grain of Phosphate of Iron, and about ¾ grain of so-called Lactophosphate of Calcium.

94. Elixir Quininæ Valerianatis et Strychninæ. *N. F.*

Elixir of Valerianate of Quinine and Strychnine.

Valerianate of Quinine,	128 gr.
Sulphate of Strychnine,	1¼ gr.
Compound Tincture of Cudbear,	120 min.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Valerianate of Quinine and the Sulphate of Strychnine with about *eight* (8) *fluidounces* of Aromatic Elixir, until they are dissolved. Then add the Compound Tincture of Cudbear, and, lastly, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains 1 grain of Valerianate of Quinine and $\frac{1}{100}$ grain of Sulphate of Strychnine.

36. Elixir Caffeinæ. *N. F.*

Elixir of Caffeine.

Caffeine,	128 gr.
Diluted Hydrobromic Acid (U. S. P.),	32 gr.
Syrup of Coffee,	4 fl. oz.
Aromatic Elixir, enough to make	16 fl. oz.

Rub the Caffeine, in a mortar, with the Diluted Hydrobromic Acid and about *two* (2) *fluidounces* of Aromatic Elixir, until solution is effected. Then add the Syrup of Coffee, and, lastly, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains 1 grain of Caffeine.

11. Caffeinæ Citras Effervescens. *N. F.*

Effervescent Citrate of Caffeine.

Caffeine,	20 parts.
Citric Acid,	20 parts.
Bicarbonate of Sodium,	600 parts.
Tartaric Acid,	540 parts.
Sugar, in very fine powder,	620 parts.

Triturate the ingredients, previously well dried, to a fine, uniform powder.

If the compound is required in form of a granular powder, mix it with Alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve, or enamelled colander. Then dry it, and reduce it to a coarse, granular powder.

Ninety (90) *grains* (*or about a heaped teaspoonful*) *of the above compound represent* 1 *grain of Caffeine.*

12. Caffeinæ Sodio-Benzoas. *N. F.*

Sodio-Benzoate of Caffeine.

Caffeine,	50 parts.
Benzoate of Sodium,	50 parts.
Alcohol,	a sufficient quantity.

Triturate the Caffeine with the Benzoate of Sodium and a sufficient quantity of Alcohol to a smooth paste, and dry this by exposure in a moderately warm place. Rub the dry mass to powder, and keep it in well-stoppered bottles.

Note.—The product contains 50 per cent. of Caffeine, and is soluble in 2 parts of water.

13. Caffeinæ Sodio-Salicylas. *N. F.*

Sodio-Salicylate of Caffeine.

Caffeine,	50 parts.
Salicylate of Sodium,	50 parts.
Alcohol,	a sufficient quantity.

Triturate the Caffeine with the Salicylate of Sodium and a sufficient quantity of Alcohol to a smooth paste, and dry this by exposure in a moderately warm place. Rub the dry mass to powder, and keep it in well-stoppered bottles.

Note.—The product contains 50 per cent. of Caffeine, and is soluble in 2 parts of water.

55. Elixir Erythroxyli. *N. F.*

Elixir of Erythroxylon.

Elixir of Coca.

Fluid Extract of Erythroxylon,	2 fl. oz.
Alcohol,	1 fl. oz.
Syrup,	2 fl. oz.
Tincture of Vanilla,	120 min.
Purified Talcum,	120 gr.
Aromatic Elixir, enough to make	16 fl. oz.

Mix the Fluid Extract with the Alcohol, the Syrup, and *ten* (10) *fluidounces* of Aromatic Elixir, add the Purified Talcum and incorporate the latter thoroughly. Let the mixture stand during forty-eight hours, if convenient, shaking occasionally; then filter, add the Tincture of Vanilla to the filtrate, and pass enough Aromatic Elixir through the filter to make the product measure *sixteen* (16) *fluidounces.*

Each fluidrachm represents 7½ *grains of Erythroxylon* (*Coca*).

56. Elixir Erythroxyli et Guaranæ. *N. F.*

Elixir of Erythroxylon and Guarana.

Elixir of Coca and Guarana.

Fluid Extract of Erythroxylon,	2 fl. oz.
Fluid Extract of Guarana,	2 fl. oz.
Purified Talcum,	120 gr.
Compound Elixir of Taraxacum,	12 fl. oz.

Mix the liquids, and thoroughly incorporate the Purified Talcum with the mixture. Let it stand during forty-eight hours, if convenient, occasionally agitating, then filter.

Each fluidrachm represents 7½ *grains each of Erythroxylon* (*Coca*) *and Guarana.*

73. Elixir Guaranæ. *N. F.*

Elixir of Guarana.

Fluid Extract of Guarana (U. S. P.),	8 fl. oz.
Aromatic Elixir,	8 fl. oz.
Compound Elixir of Taraxacum,	10 fl. oz.

Mix them, allow the mixture to stand during forty-eight hours, if convenient, and filter.

Each fluidrachm represents about 11 *grains of Guarana.*

88. Elixir Pilocarpi. *N. F.*

Elixir of Pilocarpus.

Elixir of Jaborandi.

Fluid Extract of Pilocarpus,	1 fl. oz.
Syrup of Coffee,	8 fl. oz.
Tincture of Vanilla,	½ fl. oz.
Compound Elixir of Taraxacum, enough to make	16 fl. oz.

Mix them, allow the mixture to stand during four days, if convenient, and filter.

Each fluidrachm represents 8¾ *grains of Pilocarpus.*

240. Liquor Strychninæ Acetatis. *N. F.*

Solution of Acetate of Strychnine.

Hall's Solution of Strychnine.

Acetate of Strychnine,	16 gr.
Diluted Acetic Acid,	½ fl. oz.
Alcohol,	4 fl. oz.
Compound Tincture of Cardamom,	60 min.
Water, enough to make	16 fl. oz.

Dissolve the Acetate of Strychnine in about *eight* (8) *fluidounces* of Water mixed with the Diluted Acetic Acid, then add the Alcohol, Compound Tincture of Cardamom, and, lastly, enough Water to

make *sixteen* (16) *fluidounces*. Allow the mixture to stand a few days, if convenient, and filter.

Each fluidrachm contains ⅛ grain of Acetate of Strychnine.

Note.—The Brit. Pharm. directs a *Liquor Strychninæ Hydrochloratis* (with synonyme: *Liquor Strychninæ*) which is much stronger, and should not be confounded with the above preparation. It should never be dispensed unless expressly designated. It may be prepared by dissolving 1 grain of crystallized Strychnine (alkaloid) in 80 minims of Water with the aid of 2 drops of Diluted Hydrochloric Acid, and then adding 20 minims of Alcohol. The product contains ⅛ grain of Strychnine in each fluidrachm.

104. Elixir Strychninæ Valerianatis. *N. F.*

Elixir of Valerianate of Strychnine.

Valerianate of Strychnine,	1¼ gr.
Acetic Acid,	a sufficient quantity.
Tincture of Vanilla,	120 min.
Compound Tincture of Cudbear,	120 min.
Aromatic Elixir, enough to make	16 fl. oz.

Triturate the Valerianate of Strychnine with about *one* (1) *fluidounce* of Aromatic Elixir, gradually added, and effect complete solution by the addition of one or more drops of Acetic Acid, avoiding an excess. Then add the Tinctures, and, lastly, enough Aromatic Elixir to make *sixteen* (16) *fluidounces*. Filter, if necessary.

Each fluidrachm contains $\frac{1}{100}$ grain of Valerianate of Strychnine.

270. Oleatum Aconitinæ. *N. F.*

Oleate of Aconitine.

Aconitine, alkaloid,	2 parts.
Oleic Acid,	98 parts.

Triturate the Aconitine with a small portion of the Oleic Acid in a mortar, then incorporate the remainder of the Oleic Acid, and stir the mixture frequently until the alkaloid is dissolved.

Note.—The market affords a variety of Aconitines made by different processes, by different manufacturers, and of greatly different potency. Only the pure crystallized or crystallizable alkaloid, prepared by Duquesnel's method, or at least one equal to it in strength, should be used for this preparation.

185. Glyceritum Hydrastis. *N. F.*

Glycerite of Hydrastis.

Hydrastis, in fine powder,	16 tr. oz.
Glycerin,	8 fl. oz.
Alcohol,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Moisten the Hydrastis with *six* (6) *fluidounces* of Alcohol, pack it firmly in a percolator, and percolate with Alcohol until the Hydrastis is practically exhausted. To the percolate add *four* (4) *fluidounces* of Water, and then remove the Alcohol by evaporation or distillation. After the Alcohol is driven off, add enough Water to the residue to make it measure *eight* (8) *fluidounces*, set it aside for twenty-four hours, then filter, pass enough Water through the filter to make the filtrate measure *eight* (8) *fluidounces*, and, lastly, add the Glycerin.

194. Linimentum Aconiti et Chloroformi. *N. F.*

Liniment of Aconite and Chloroform.

Tincture of Aconite,	2 fl. oz.
Chloroform,	2 fl. oz.
Soap Liniment,	12 fl. oz.

Mix them.

353. Syrupus Coffeæ. *N. F.*

Syrup of Coffee.

Coffee, roasted,	8 tr. oz.
Sugar,	24 tr. oz.
Water,	a sufficient quantity.

Introduce the Coffee, reduced to a moderately coarse powder, into a suitable vessel; pour upon it *sixteen* (16) *fluidounces* of boiling Water, then cover it well, and boil for five minutes. Allow it to become cold, keeping the vessel well covered; strain off the liquid and pass enough Water through the strainer to make the strained liquid, when cold, measure *sixteen* (16) *fluidounces*. In this dissolve the Sugar, by agitation, without heat, and strain through muslin.

Note.—It is recommended that a mixture of equal parts of the commercial varieties of Coffee, known as "Java" and "Mocha," be employed for this purpose. The Coffee may also be exhausted by percolation, but special arrangements are then necessary to maintain the menstruum at the proper temperature.

371. Syrupus Ipecacuanhæ et Opii. *N. F.*

Syrup of Ipecac and Opium.

Syrup of Dover's Powder.

Fluid Extract of Ipecac,	64 min.
Deodorized Tincture of Opium (U. S. P.),	670 min.
Sugar,	12 tr. oz.
Cinnamon Water, enough to make	16 fl. oz.

Mix the Fluid Extract and Tincture with *six* (6) *fluidounces* of Cinnamon Water, and filter the liquid. To this add the Sugar and enough Cinnamon Water to make the product, after the Sugar has been dissolved by agitation, measure *sixteen* (16) *fluidounces*.

Each fluidrachm represents 5 grains of Dover's Powder, or ½ grain, each, of Ipecac and Opium.

Note.—In place of the above-directed quantities of Fluid Extract of Ipecac and Deodorized Tincture of Opium, 640 minims of the officinal *Tinctura Ipecacuanhæ et Opii* may be taken.

380. Syrupus Sanguinariæ. *N. F.*

Syrup of Sanguinaria.

Syrup of Bloodroot.

Sanguinaria, in No. 20 powder,	3½ tr. oz.
Acetic Acid,	2 fl. oz.
Sugar,	18 tr. oz.
Water, enough to make	16 fl. oz.

Mix the Acetic Acid with *six* (6) *fluidounces* of Water, moisten the Sanguinaria with a sufficient quantity of this menstruum, and allow it to macerate for two hours. Then pack it in a glass percolator, and percolate in the usual manner, first with the remainder of the menstruum previously prepared, and afterwards with Water until *twelve* (12) *fluidounces* of percolate are obtained, or until the Sanguinaria is practically exhausted. Evaporate the percolate, at a moderate heat, to *seven* (7) *fluidounces*. In this dissolve the Sugar with a gentle heat, if necessary, and add enough Water to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents about 18 *grains of Sanguinaria.*

406. Tinctura Pectoralis. *N. F.*

Pectoral Tincture.

Guttæ Pectorales. Pectoral Drops. Bateman's Pectoral Drops.

Tincture of Opium,	320 min.
Compound Tincture of Catechu,	240 min.
Spirit of Camphor,	300 min.
Oil of Anise,	8 min.
Caramel,	120 min.
Diluted Alcohol, enough to make	16 fl. oz.

Mix the first five ingredients with enough Diluted Alcohol to make *sixteen* (16) *fluidounces*, and filter.

Each fluidrachm contains 2½ *minims of Tincture of Opium.*

393. Tinctura Cinchonæ Detannata. *N. F.*

Detannated Tincture of Cinchona.

Fluid Extract of Cinchona (U. S. P.),	8 fl. oz.
Alcohol,	8 fl. oz.
Solution of Tersulphate of Iron,	6 fl. oz.
Water of Ammonia,	6 fl. oz.
Water, Diluted Alcohol, each,	a sufficient quantity.

To the Water of Ammonia, diluted with *twenty-four* (24) *fluidounces* of Water, gradually add the Solution of Tersulphate of Iron, previously diluted with *forty* (40) *fluidounces* of Water, under constant stirring. Pour this mixture, containing Ferric Hydrate as a precipitate, upon a wet muslin strainer (which has been tared, after having been wetted and deprived of the excess of water by moderate pressure), and when the liquid has drained off, return the precipitate to the vessel, and mix it intimately with about *sixty-four* (64) *fluidounces* of Water. Again drain it on the strainer, transfer it once more to the vessel, and treat it as before. Finally, drain and press the precipitate on the strainer until it weighs *eight* (8) *troyounces*.

Mix the Fluid Extract of Cinchona with *eight* (8) *fluidounces* of Alcohol, and add the Ferric Hydrate previously prepared. Agitate the mixture frequently until the tincture is deprived of tannin, which may be known by the absence of a blackish-green color when a small portion of the clear tincture is treated with a drop or two of tincture of chloride of iron. Insert a plug of absorbent cotton into a suitable percolator, and introduce the mixture. As soon as the liquid has disappeared from the surface, pour on enough Diluted Alcohol to make the product measure *sixteen* (16) *fluidounces*.

Note.—This preparation is practically identical, in strength of Cinchona (without the tannin), with the officinal *Tinctura Cinchonæ*.

387. Tinctura Aconiti, Fleming. *N. F.*

Fleming's Tincture of Aconite.

1. Aconite (root), in fine powder,	10 tr. oz.
Alcohol, enough to make	15 fl. oz.

Moisten the Aconite with enough Alcohol to render it distinctly damp and to maintain it so after twenty-four hours' maceration in a well-covered vessel. Then pack it tightly in a percolator, and percolate it slowly, in the usual manner, with Alcohol, until *fifteen* (15) *fluidounces* of tincture are obtained.

Note.—This preparation is still prescribed by many physicians. It is recommended that their attention be directed to the officinal Fluid Extract and Tincture of Aconite, so that the above preparation may be gradually abandoned.

When this preparation is required for immediate use, and it is not otherwise available, it may be prepared in the following manner:

Fluid Extract of Aconite,	10 fl. oz.
Alcohol,	5 fl. oz.

Mix them.

405. Tinctura Papaveris. *N. F.*

Tincture of Poppy.

Poppy capsules, freed from seeds, and in coarse powder,	8 tr. oz.
Glycerin,	2 fl. oz.
Alcohol, Water, each, enough to make	16 fl. oz.

Digest the Poppy capsules with *three* (3) *pints* of boiling Water during two hours, then express and strain. Evaporate the strained liquid to *eight* (8) *fluidounces*, mix it with *four* (4) *fluidounces* of Alcohol, and set the mixture aside, well covered, until it is quite cold. Then filter, add the Glycerin to the filtrate, and pass enough of a mixt-

ure of *two* (2) *volumes* of Water and *one* (1) *volume* of Alcohol through the filter to make the product measure *sixteen* (16) *fluidounces*.

Each fluidrachm represents 80 *grains of Poppy capsules freed from seeds.*

288. Pilulæ Antidyspepticæ. *N. F.*

Antidyspeptic Pills.

	Each pill contains:
Strychnine, alkaloid,	1/40 gr.
Ipecac, in fine powder,	1/16 gr.
Alcoholic Extract of Belladonna,	1/16 gr.
Mass of Mercury,	2 gr.
Compound Extract of Colocynth,	2 gr.

290. Pilulæ Antiperiodicæ. *N. F.*

Antiperiodic Pills.

Warburg's Pills.

1. *With Aloes.*	*Each pill contains:*
Aqueous Extract of Aloes,	1 gr.
Rhubarb,	½ gr.
Angelica Seed,	½ gr.
Elecampane,	¼ gr.
Saffron,	¼ gr.
Fennel,	¼ gr.
Zedoary, root,	⅛ gr.
Cubebs,	⅛ gr.
Myrrh,	⅛ gr.
White Agaric,	⅛ gr.
Camphor,	⅛ gr.
Sulphate of Quinine,	1¼ gr.
Extract of Gentian, a sufficient quantity.	

Reduce the drugs to a fine, uniform powder, and make this into pills, by means of Extract of Gentian, in accordance with the formula above given.

2. *Without Aloes.*

Prepare the pills in the same manner as directed in the previous formula, but omit the Aqueous Extract of Aloes.

Note.—These pills have been introduced for the purpose of facilitating the administration of Warburg's Tincture in a solid form. When "Warburg's Pills," or "Pills of Warburg's Tincture," are prescribed, without further specification, those containing Aloes should be dispensed. Those without Aloes should be furnished only when they are expressly demanded.

Each Warburg's Pill represents about 1 fluidrachm of Warburg's Tincture, with or without aloes, respectively. (See *Tinctura Antiperiodica.*)

429. Vinum Erythroxyli. *N. F.*

Wine of Erythroxylon.

Wine of Coca.

Fluid Extract of Erythroxylon,	1 fl. oz.
Alcohol,	1 fl. oz.
Sugar,	1 tr. oz.
Claret Wine, enough to make	16 fl. oz.

Dissolve the Sugar in about *ten* (10) *fluidounces* of Claret Wine, add the Alcohol and Fluid Extract, and enough Claret Wine to make *sixteen* (16) *fluidounces*. Let the mixture stand a few days in a cold place, if convenient, then filter, and pass enough Claret Wine through the filter to restore the original volume.

Each fluidounce represents 30 *grains of Erythroxylon* (*Coca*).

Note.—In place of Claret Wine, any other palatable wine may be used, according to the demand or preference of the prescriber or consumer.

430. Vinum Erythroxyli Aromaticum. *N. F.*

Aromatic Wine of Erythroxylon.

Aromatic Wine of Coca.

Fluid Extract of Erythroxylon,	1 fl. oz.
Compound Elixir of Taraxacum,	60 min.
Syrup of Coffee,	180 min.
Port Wine,	2½ fl. oz.
Aromatic Elixir,	4½ fl. oz.
Sherry Wine, enough to make	16 fl. oz.

Mix the five first-named ingredients with *seven* (7) *fluidounces* of Sherry Wine. Let the mixture stand several days in a cold place, if convenient, then filter, and pass enough Sherry Wine through the filter to make the product measure *sixteen* (16) *fluidounces*.

Each fluidounce represents 30 *grains of Erythroxylon* (*Coca*).

390. Tinctura Antiperiodica. *N. F.*

Antiperiodic Tincture.

Warburg's Tincture.

1. *Without Aloes.*

Rhubarb,	448 gr.
Angelica (seed),	448 gr.
Elecampane,	224 gr.
Saffron,	224 gr.
Fennel,	224 gr.
Gentian,	112 gr.
Zedoary (root),	112 gr.
Cubeb,	112 gr.
Myrrh,	112 gr.
White Agaric,	112 gr.
Camphor,	112 gr.
Sulphate of Quinine,	1280 gr.
Diluted Alcohol, enough to make	8 pints.

Reduce the fibrous vegetable drugs to a coarse (No. 20) powder, mix this with the Myrrh and Camphor, previously powdered, and digest the whole, during twelve hours, in a suitable, well-covered vessel, with *seven* (7) *pints* of Diluted Alcohol, on a water-bath, avoiding, as much as possible, any loss of Alcohol by evaporation. Then strain off the liquid with pressure, dissolve the Sulphate of Quinine in the strained liquid, with a gentle heat, if necessary, filter, and pass enough Diluted Alcohol, first through the strainer and then through the filter, to make the product measure *eight* (8) *pints*.

Each fluidounce contains 10 *grains of Sulphate of Quinine.*

Note.—This preparation, made *without Aloes*, is intended to serve as a stock-tincture, from which

the regular "Warburg's Tincture" is to be made, when required. "Warburg's Tincture without Aloes" is also often prescribed or asked for, and in this case the above preparation is to be dispensed.

The original formula directed by Dr. Warburg contained the old *Confectio Damocratis* as one of the ingredients. This is a very complex preparation, many of the constituents of which are unobtainable at the present day. It has, therefore, been omitted.

2. *With Aloes.*

Aqueous Extract of Aloes, 28 gr.
Antiperiodic Tincture, without Aloes, 16 fl. oz.

Dissolve the Extract in the Tincture.

Note.—When "Warburg's Tincture," without any further specification, is ordered, this preparation (containing Aloes) is to be dispensed.

Compound Tincture of Ignatia.

(Gouttes Amères. Bitter Drop.)

Ignatia, 8 oz. (troy).
Alcohol, 60 per cent., 16 oz. (by weight).
Potassium Carbonate, 80 gr.
Charcoal, 6 gr.
Oil of Wormwood, 6 fl. dr.

Macerate fifteen days, and then recover 16 fl. oz. by percolation.

Vinum Tabaci. *U. S.* 1870.

Wine of Tobacco.

Tobacco, 240 gr.
White Wine, 8 fl. oz.

Macerate and filter.

Rheumatic Pills.

(Dr. Isaac Remington's.)

Acetic Extract of Colchicum,
Compound Extract of Colocynth,
Extract of Rhubarb, of each, 60 gr.
Veratrine, 5 gr.
Oil of Anise, 10 drops.

Make into 40 pills. Take 1 or 2 at bedtime.

Ethereal Tincture of Colchicum.

Colchicum, 8 oz. (troy).
Spirit of Nitrous Ether, sufficient to make 8 fl. oz.

Made by percolation. Dose, 20 to 30 drops.

Linimentum Aconiti. *U. S.* 1870.

Liniment of Aconite.

Aconite, in fine powder, 8 oz. (troy).
Glycerin, 1 fl. oz.
Alcohol, a sufficient quantity.

Moisten the powder with 4 fl. oz. of Alcohol, and let it macerate for twenty-four hours, then pack in a conical percolator, and gradually pour Alcohol upon it until 2 pints of tincture have been obtained. Distil off a pint and a half of Alcohol, and evaporate the remainder until it measures 7 fl. oz.; to this add the Glycerin, and mix them thoroughly.

Gout Pills.

(Becquerel's.)

Quinine Sulphate, 60 gr.
Extract of Digitalis, 7½ gr.
Powdered Colchicum-Seed, 20 gr.

Make into a mass and divide into 25 pills. Dose, 1 to 3 pills each day for several days.

Gout Pills.

(Lartigue's.)

Compound Extract of Colocynth, 96 gr.
Acetated Extract of Colchicum, 10 gr.
Extract of Digitalis, 5 gr.

Make into a mass and divide into 24 pills. Take 2 for a dose.

Mixture for Gout.

(Scudamore's.)

Magnesium Sulphate, 240 gr.
Magnesia, 80 gr.
Vinegar of Colchicum, 4 fl. dr.
Syrup of Saffron, 4 fl. dr.
Peppermint Water, 5 fl. oz.

Mix. Dose, 1 to 3 tablespoonfuls every two hours till four to six evacuations are produced in twenty-four hours.

Remedy for Tape-Worm.

(Schafhirt's.)

Pomegranate, 240 gr.
Pumpkin-Seed, 1 oz. (troy).
Ethereal Extract of Aspidium, 60 gr.
Powdered Ergot, 30 gr.
Powdered Acacia, 120 gr.
Croton Oil, 2 min.

Mix.

Dinner Pills.

(Fothergill's.)

Powdered Ipecac, 20 gr.
Strychnine, 1 gr.
Oil of Black Pepper, 40 min.
Pill of Aloes and Myrrh, 50 gr.

Mix, and make into 20 pills.

Number One.

(Thomsonian name.)

Lobelia inflata.

Brown Lobelia.

The Thomsonian name for the *seed*.

Green Lobelia.

The Thomsonian name for the *herb*.

Third Preparation.

(Thomsonian name.)

Lobelia-Seed,
Capsicum, of each, 1 oz. (av.).
Cypripedium Powder, 10 gr.

Add 12 fl. oz. of Number Six (page 1208), macerate, and keep on the dregs.

Syrup of Lobelia.

(Thomsonian name.)

Lobelia-Seed,	1 oz. (av.).
Sugar,	16 oz. (av.).
Tincture of Lobelia,	4 fl. oz.
Vinegar,	1 fl. oz.
Water,	16 fl. oz.

Boil the Seed with the Vinegar and Water for half an hour; add the Sugar; and lastly, when cold, add the Tincture of Lobelia.

Tobacco Ointment.

Tobacco, in fine powder,	120 gr.
Lard,	4 oz. (troy).
Water, sufficient.	

Percolate the Tobacco with Water until 2 fl. oz. have been obtained, evaporate to an extract, and mix with the Lard.

Compound Elixir of Turkey Corn.

Fluid Extract of Corydalis,	4 fl. dr.
Fluid Extract of Stillingia,	4 fl. dr.
Fluid Extract of Prickly Ash,	2 fl. oz.
Fluid Extract of Iris,	6 fl. oz.
Potassium Iodide,	180 gr.
Alcohol,	1 fl. oz.
Elixir of Orange,	5 fl. oz.

Mix the Elixir and Alcohol, and add the Fluid Extracts; dissolve the Iodide in the mixture, and allow it to stand twenty-four hours, then filter.

ANIMAL PRODUCTS.

279. Pepsinum. *N. F.*

Pepsin.

The digestive principle of the gastric juice, obtained from the mucous membrane of the stomach of the hog, prepared in a dry and undiluted form, and capable of dissolving not less than *five hundred* (500) *times* its own weight of hard-boiled egg-albumen, under the conditions prescribed for the process of assay below given.

Assay of Pepsin.

1. *Preliminary Assay.*—Prepare an Acidulated Water by mixing 1 litre of Distilled Water with 5 Gm. of Hydrochloric Acid. Mix 0·1 Gm. of the dry and undiluted Pepsin with 0·9 Gm. of Sugar of Milk, by thorough trituration in a Wedgwood mortar. Weigh of this mixture four portions, of 0·05 Gm. (*A*), 0·06 Gm. (*B*), 0·1 Gm. (*C*), and 0·2 Gm. (*D*), respectively, place each portion in a wide-mouthed flask or bottle of the capacity of about 200 C.c., together with 80 C.c. of the Acidulated Water, previously warmed, and set the flasks in a water-bath, the temperature of which is maintained constantly at 51·6° C. (125° F.). After twenty minutes, add to the contents of each flask 10 Gm. of hard-boiled egg-albumen, prepared by boiling fresh eggs for fifteen minutes, then separating the whites and rubbing this through a clean hair sieve having 30 meshes to the linear inch. Each portion of 10 Gm. of egg-albumen is to be put into a small warmed mortar, triturated with a portion of the fluid from one of the flasks, the mixture then transferred to the latter, and the mortar rinsed with 20 C.c. of warmed Acidulated Water, which is added to the contents of the flask. Keep the flasks in the water-bath for sixty minutes, shaking well at intervals of five minutes, and at the end of that time note the condition of the egg-albumen in the several flasks. If the Pepsin is of good quality, not more than a few undissolved flakes should remain in any but the first flask (*A*). If more than this remains in the fourth flask (*D*), the Pepsin should be rejected, as being below the requisite standard.

2. *Actual Assay.*—Having thus ascertained the approximate digestive power of the Pepsin, and having found this to be of satisfactory strength, make at least two assays, in precisely the same manner as just described, but using such a proportion of egg-albumen that about one-fourth of it will remain undissolved at the close of the experiment.

Then add to the contents of the flask 3 Gm. of finely-scraped and purified asbestos, previously dried to a constant weight, and afterwards add 100 C.c. of cold distilled water. Shake the flask strongly, until the asbestos has clarified the liquid as far as possible, then transfer the contents of the flask to a tared filter (deprived of matters soluble in hydrochloric acid), wash the residue with distilled water, until the washings cease to affect test-solution of nitrate of silver acidulated with nitric acid, and dry the filter with contents at a temperature of 105° C. (221° F.), to a constant weight. From this deduct the weight of the filter and asbestos. Multiply the remainder (representing the undigested and dried albumen) by 7·5, to find the quantity of moist egg-albumen to which it corresponds, and deduct the product from the amount originally used to ascertain the proportion dissolved by the Pepsin.

Note.—Finely-scraped asbestos has been found to be the best medium for clarifying liquids containing peptones. Pure, white, fibrous asbestos should be scraped with a knife so as to obtain a fine feathery mass, which is boiled with diluted hydrochloric acid, then thoroughly washed with water, and dried. If it is to be used in quantitative determinations requiring its subsequent ignition, it should be ignited before its tare is taken.

281. Pepsinum Saccharatum. *N. F.*

Saccharated Pepsin.

Pepsin (N. F.),	a sufficient quantity.
Sugar of Milk, enough to make 100 parts.	

Triturate as many parts of the Pepsin as may be found to be capable of dissolving *five thousand* (5000) *parts* of egg-albumen by the process of assay given under *Pepsinum*, with enough Sugar of Milk to make *one hundred* (100) *parts*.

Note.—The process of assay given under *Pepsinum* (see No. 279) is also applicable to this preparation.

Pepsinum Saccharatum is officinal in the U. S. P., but no process is there given for its preparation. The product obtained by the above formula corresponds, in strength, to that intended by the U. S. P.

280. Pepsinum Aromaticum. *N. F.*

Aromatic Pepsin.

Saccharated Pepsin,	1 tr. oz.
Aromatic Fluid Extract (U. S. P.),	30 min.
Tartaric Acid,	8 gr.
Chloride of Sodium,	8 gr.

Mix the ingredients by trituration, dry the product by exposure to warm air, and keep it in well-stoppered bottles.

319. Pulvis Pepsini Compositus. *N. F.*

Compound Powder of Pepsin.

Pulvis Digestivus.

Saccharated Pepsin,	150 gr.
Pancreatin (N. F.),	150 gr.
Diastase,	10 gr.
Lactic Acid,	10 min.
Hydrochloric Acid,	20 min.
Sugar of Milk, enough to make	1000 gr.

Add the Acids gradually to the Sugar of Milk, and triturate until they are thoroughly mixed. Mix the Pepsin, Pancreatin, and Diastase, and then incorporate this mixture, by trituration, with the Sugar of Milk. Finally, rub the mixture through a hair sieve, and preserve the powder in bottles.

Note.—The best commercial variety of Diastase, capable of converting the largest comparative amount of starch into dextrin and glucose, should be used for this preparation.

81. Elixir Pepsini. *N. F.*

Elixir of Pepsin.

Pepsin (N. F.),	128 gr.
Hydrochloric Acid,	80 min.
Glycerin,	2 fl. oz.
Compound Elixir of Taraxacum,	1 fl. oz.
Alcohol,	8 fl. oz.
Purified Talcum,	120 gr.
Sugar,	4 tr. oz.
Water, enough to make	16 fl. oz.

Mix the Pepsin with *six* (6) *fluidounces* of Water, add the Glycerin and Acid, and agitate until solution has been effected. Then add the Compound Elixir of Taraxacum, Alcohol, and the Purified Talcum, and mix thoroughly. Set the mixture aside for a few hours, occasionally agitating. Then filter it through a wetted filter, dissolve the Sugar in the filtrate, and pass enough Water through the filter to make the whole product measure *sixteen* (16) *fluidounces.*

Each fluidrachm represents 1 *grain of Pepsin* (*N. F.*).

Note.—The filtration of this preparation will be greatly facilitated by allowing the mixture to stand a few days before pouring it on the filter.

84. Elixir Pepsini et Ferri. *N. F.*

Elixir of Pepsin and Iron.

Tincture of Citro-Chloride of Iron,	512 min.
Elixir of Pepsin, enough to make	16 fl. oz.

Mix the Tincture of Citro-Chloride of Iron with a sufficient quantity of Elixir of Pepsin to make *sixteen* (16) *fluidounces*, and filter, if necessary.

Each fluidrachm represents about ½ *grain of Chloride of Iron* (*ferric*) *and nearly* 1 *grain of Pepsin* (*N. F.*).

432. Vinum Pepsini. *N. F.*

Wine of Pepsin.

Pepsin (N. F.),	128 gr.
Glycerin,	800 min.
Hydrochloric Acid,	80 min.
Water,	1 fl. oz.
Purified Talcum,	120 gr.
Stronger White Wine (U.S.P.), enough to make	16 fl. oz.

Mix the Water, Glycerin, and Hydrochloric Acid, and agitate the Pepsin with the mixture until it is completely disintegrated and apparently dissolved. Then add enough Stronger White Wine to make *sixteen* (16) *fluidounces*, mix the liquid intimately with the Purified Talcum, allow it to stand for a week, if convenient, frequently shaking, then filter, and pass enough Stronger White Wine through the filter to restore the original volume.

Each fluidrachm represents 1 *grain of Pepsin* (*N. F.*).

227. Liquor Pepsini Aromaticus. *N. F.*

Aromatic Solution of Pepsin.

Pepsin (N. F.),	128 gr.
Oil of Cinnamon,	2 drops.
Oil of Pimenta,	2 drops.
Oil of Cloves,	4 drops.
Purified Talcum,	120 gr.
Alcohol,	½ fl. oz.
Hydrochloric Acid,	75 min.
Glycerin,	4 fl. oz.
Water, enough to make	16 fl. oz.

Mix the Pepsin with *eight* (8) *fluidounces* of Water and the Hydrochloric Acid, and shake the mixture frequently until the Pepsin is dissolved. Then add the Purified Talcum and the Oils, previously dissolved in the Alcohol; mix the whole thoroughly, by agitation, and filter it through a wetted filter, returning the first portions of the liquid until it runs through clear. Pass enough Water through the filter to make the filtrate measure *twelve* (12) *fluidounces.* To this add the Glycerin.

Each fluidrachm represents 1 *grain of Pepsin* (*N. F.*).

186. Glyceritum Pepsini. *N. F.*

Glycerite of Pepsin.

Pepsin (N. F.),	640 gr.
Hydrochloric Acid,	80 min.
Purified Talcum,	120 gr.
Glycerin,	8 fl. oz.
Water, enough to make	16 fl. oz.

Mix the Pepsin with *seven* (7) *fluidounces* of Water and the Hydrochloric Acid, and agitate until solution has been effected. Then incorporate the Purified Talcum with the liquid, filter, returning the first portions of the filtrate until it runs through clear, and pass enough

Water through the filter to make the filtrate measure *eight* (8) *fluidounces*. To this add the Glycerin, and mix.

Each fluidrachm represents 5 grains of Pepsin (N. F.).

Note.—For filtering the aqueous solution of Pepsin first obtained by the above formula, as well as for filtering other liquids of a viscid character, a filter paper of loose texture (preferably that known as "Textile Filtering Paper"), or a layer of absorbent cotton placed in a funnel, or percolator, should be employed.

226. Liquor Pancreaticus. N. F.

Pancreatic Solution.

Pancreatin (N. F.),	128 gr.
Bicarbonate of Sodium,	384 gr.
Glycerin,	4 fl. oz.
Compound Spirit of Cardamom (N. F.),	½ fl. oz.
Alcohol,	½ fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Triturate the Pancreatin and the Bicarbonate of Sodium gradually with *ten* (10) *fluidounces* of Water; add the Alcohol, Compound Spirit of Cardamom, and Purified Talcum; mix them thoroughly by shaking, and pour the mixture upon a wetted filter, returning the first portions of the filtrate until it runs off clear. Wash the filter with enough Water to obtain *twelve* (12) *fluidounces* of filtrate. To this add the Glycerin.

Each fluidrachm represents 1 grain of Pancreatin (N. F.).

278. Pancreatinum. N. F.

Pancreatin.

Pancreas of the Hog, fresh,	
Water,	
Alcohol,	each, a sufficient quantity.

Reduce the fresh Pancreas of the Hog, freed as much as possible from fat and membranes, to a fine paste by means of a suitable chopping machine. Mix it with half its weight of cold Water, and knead it thoroughly and frequently during one hour; then transfer the mass to a strainer, express it forcibly, filter the liquid as quickly as possible through flannel, and add to the filtrate an equal volume of Alcohol. Collect the precipitate, drain it, and free it by pressure from as much of the adherent liquid as possible. Then spread it on shallow trays, dry it by exposure to warm air, at a temperature not exceeding 40° C. (104° F.), reduce it to powder, and keep it in well-stoppered bottles.

Note.—If larger quantities of Pancreas are operated upon, and there is risk of its decomposition in presence of the water, it is advisable to saturate the latter with chloroform, which will retard decomposition for a long time.

If there be added to 4 fluidounces of tepid water, contained in a suitable flask or bottle, first, 5 grains of Pancreatin and 20 grains of bicarbonate of sodium, and afterwards 1 pint of fresh cow's milk, previously heated to 38° C. (100·4° F.), and if this mixture be maintained at the same temperature for thirty minutes, the milk should be so completely peptonized that, on adding to a small portion of it, transferred to a test-tube, a slight excess of nitric acid, coagulation should not occur.

As peptonized milk is chiefly used as a food for the sick, and as Pancreatin is probably more largely employed for the practical purpose of peptonizing milk, it is important to observe the quality of the peptonized product yielded with any specimen of Pancreatin. Peptonized milk as prepared by the above process, or when the process is allowed to go on to the development of a very distinct bitter flavor, should not have an odor at all suggestive of rancidity. Milk has simply a marked bitter taste when thoroughly peptonized.

In place of Pancreatin, prepared by the formula above given, any other commercial preparation of the Pancreas may be used, provided it reaches the standard of peptonizing power prescribed for the former. (See also *Note* to No. 318, below.)

318. Pulvis Pancreaticus Compositus. N. F.

Compound Pancreatic Powder.

Peptonizing Powder.

Pancreatin (N. F.),	5 gr.
Bicarbonate of Sodium,	20 gr.

Mix them by trituration.

Note.—If Pancreatin of proper strength (see No. 278) is not available, any other commercial preparation of the Pancreas, as, for instance, the extract, may be used in place of it, provided it attains the required standard.

The quantities above given are sufficient to peptonize 1 pint of fresh cow's milk, by proceeding in the following manner:

Add the Compound Pancreatic Powder to 4 fluidounces of tepid water, contained in a suitable flask, and afterwards add 1 pint of fresh cow's milk, previously heated to 38° C. (100·4° F.). Maintain the mixture at this temperature during thirty minutes, then transfer the flask to a cold place.

Milk thus peptonized should not be used when it has been kept over twenty-four hours or when it has developed a rancid taste.

349. Succus Limonis cum Pepsino. N. F.

Lime Juice and Pepsin.

Pepsin (N. F.),	256 gr.
Water,	8 fl. oz.
Glycerin,	8 fl. oz.
Alcohol,	1½ fl. oz.
Purified Talcum,	120 gr.
Lime Juice, enough to make	16 fl. oz.

Dissolve the Pepsin in the Water, mixed with about *eight* (8) *fluidounces* of Lime Juice. Then add the Glycerin and Alcohol, and, lastly, enough Lime Juice to make *sixteen* (16) *fluidounces*. Incorporate the Purified Talcum with the liquid, let it stand a few days in a cold place, if convenient, occasionally agitating, then filter it through a wetted filter, and, finally, pass enough Lime Juice through the filter to restore the original volume.

Each fluidrachm represents 2 grains of Pepsin (N. F.).

82. Elixir Pepsini, Bismuthi, et Strychninæ. *N. F.*

Elixir of Pepsin, Bismuth, and Strychnine.

Sulphate of Strychnine,	1¼ gr.
Elixir of Pepsin and Bismuth,	16 fl. oz.

Dissolve the Sulphate of Strychnine in the Elixir.

Each fluidrachm represents $\frac{1}{100}$ grain of Sulphate of Strychnine, 1 grain of Pepsin (N. F.), and 2 grains of Citrate of Bismuth and Ammonium.

83. Elixir Pepsini et Bismuthi. *N. F.*

Elixir of Pepsin and Bismuth.

Pepsin (N. F.),	128 gr.
Citrate of Bismuth and Ammonium,	256 gr.
Water of Ammonia, a sufficient quantity.	
Glycerin,	2 fl. oz.
Alcohol,	8 fl. oz.
Syrup,	8 fl. oz.
Compound Elixir of Taraxacum,	1 fl. oz.
Purified Talcum,	120 gr.
Water, enough to make	16 fl. oz.

Dissolve the Pepsin in *four* (4) *fluidounces* of Water. Dissolve the Citrate of Bismuth and Ammonium in *one* (1) *fluidounce* of warm Water, allow the solution to stand until clear, if necessary; then decant the clear liquid, and add to the residue just enough Water of Ammonia to dissolve it, carefully avoiding an excess. Then mix the two solutions, and add the Glycerin, Compound Elixir of Taraxacum, and Alcohol. Thoroughly incorporate the Purified Talcum with the mixture, filter it through a wetted filter, and pass enough Water through the filter to make the filtrate measure *thirteen* (13) *fluidounces*. To this add the Syrup.

Each fluidrachm represents 1 grain of Pepsin (N. F.) and 2 grains of Citrate of Bismuth and Ammonium.

Emulsion of Cod Liver Oil with Phosphate of Calcium and Sodium.

Calcium Phosphate,	256 gr.
Sodium Phosphate,	64 gr.
Acacia,	2 oz. (av.).
Hydrochloric Acid,	128 min.
Cod Liver Oil,	8 fl. oz.
Water,	4 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Dissolve the Phosphates in the Water by the aid of the Acid, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

Emulsion of Cod Liver Oil.

(50 per cent.)

Cod Liver Oil,	8 fl. oz.
Powdered Acacia,	2 oz. (av.).
Water,	4 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth; then add the Water all at once, and rub until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Lactophosphate of Calcium.

Calcium Lactate,	256 gr.
Acacia,	2 oz. (av.).
Diluted Phosphoric Acid,	2 fl. oz.
Cod Liver Oil,	8 fl. oz.
Water,	2 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Dissolve the Calcium Lactate in Acid and Water, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

Pancreatic Emulsion of Cod Liver Oil.

Cod Liver Oil,	8 fl. oz.
Powdered Pancreatin,	60 gr.
Syrup,	1 fl. oz.

Digest at a moderate heat. The emulsion is miscible with water, and may be given in chocolate, milk, coffee, or both.

Emulsion of Cod Liver Oil with Wild Cherry Bark.

Acacia,	2 oz. (av.).
Oil of Bitter Almond,	8 min.
Fluid Extract of Wild Cherry,	1 fl. oz.
Cod Liver Oil,	8 fl. oz.
Water,	3 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Mix the Fluid Extract with the Water, and add all at once to the above mixture; then add the Oil of Bitter Almond, and, lastly, sufficient Water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Hypophosphites.

Calcium Hypophosphite,	128 gr.
Sodium Hypophosphite,	96 gr.
Potassium Hypophosphite,	64 gr.
Acacia,	2 oz. (av.).
Cod Liver Oil,	8 fl. oz.
Water,	4 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Dissolve the Hypophosphites in the Water, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Hypophosphite of Calcium and Sodium.

Calcium Hypophosphite,	128 gr.
Sodium Hypophosphite,	96 gr.
Powdered Acacia,	2 oz. (av.).
Cod Liver Oil,	8 fl. oz.
Water,	4 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Dissolve the Hypophosphites in the Water, and add all at once to the above mixture, rubbing until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

Emulsion of Cod Liver Oil with Hypophosphite of Calcium.

Cod Liver Oil,	8 fl. oz.
Powdered Acacia,	2 oz. (av.).
Calcium Hypophosphite,	128 gr.
Water,	4 fl. oz.

Place the Powdered Acacia in a dry mortar, add the Cod Liver Oil, and rub until smooth. Dissolve the Calcium Hypophosphite in the Water, and add all at once to the above, rubbing until a perfect emulsion is formed; then add sufficient Water to make 16 fl. oz.

114. Emulsio Olei Morrhuæ. *N. F.*

Emulsion of Cod Liver Oil.

I. Irish Moss Emulsion of Cod Liver Oil.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Syrup of Tolu,	2 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Pour the Mucilage of Chondrus into a suitable bottle, add the Cod Liver Oil in divided portions, shaking well after each addition, and, when a perfect emulsion is formed, add the Syrup of Tolu and the Flavoring, and, lastly, enough Water to make *sixteen* (16) *fluidounces.* Finally, mix the whole thoroughly together.

This emulsion may also be prepared by mixing the Mucilage of Chondrus with the Oil and other ingredients in a mortar, or, when larger quantities are to be prepared, it may be mixed by some mechanical contrivance.

Note.—When Emulsion of Cod Liver Oil, particularly that made with Chondrus, is to be kept for some time, its deterioration may be prevented or retarded by the addition of *one* (1) *fluidounce* of Alcohol in place of the same quantity of Water, after the oil has been emulsified.

Emulsion of Cod Liver Oil may also be prepared by any other method capable of emulsifying the oil, the following being given as examples:

II. Acacia Emulsion of Cod Liver Oil. *N. F.*

Cod Liver Oil,	8 fl. oz.
Acacia, in fine powder,	1½ tr. oz.
Syrup of Tolu,	2 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Triturate the Acacia with *three* (3) *fluidounces* of Water to a smooth paste; then add the Cod Liver Oil and the Syrup of Tolu, alternately, and in divided portions, triturating well until the last-added portion of the Oil is thoroughly emulsified. Next add the Flavoring, and, lastly, enough Water to make *sixteen* (16) *fluidounces.* Finally, mix the whole thoroughly together.

III. Glyconin Emulsion of Cod Liver Oil. *N. F.*

Cod Liver Oil,	8 fl. oz.
Glycerite of Yolk of Egg (U. S. P.),	2½ fl. oz.
Syrup of Tolu,	2 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Triturate the Glycerite of Yolk of Egg (Glyconin) in a mortar with the Oil, added in small portions at a time, and thoroughly incorporate each portion before adding the next. Then, continuing the trituration, gradually add the Syrup of Tolu and the Flavoring. Finally, add enough Water to make *sixteen* (16) *fluidounces*, and mix the whole thoroughly together.

IV. Quillaja Emulsion of Cod Liver Oil. *N. F.*

Cod Liver Oil,	8 fl. oz.
Tincture of Quillaja (N. F.),	1 fl. oz.
Syrup of Tolu,	2 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Pour the Tincture into a suitable bottle, then add the Cod Liver Oil in portions of about *two* (2) *fluidounces* each, and shake after each addition until a perfect emulsion results. Next add the Syrup of Tolu and the Flavoring, and, lastly, enough Water to make *sixteen* (16) *fluidounces.* Finally, mix the whole thoroughly together.

An 85 per cent. Emulsion of Cod Liver Oil may be prepared by mixing in the manner just described:

Cod Liver Oil,	8½ fl. oz.
Tincture of Quillaja (N. F.),	1 fl. oz.
Flavoring,	a sufficient quantity.
Syrup of Tolu,	enough to make 10 fl. oz.

Note.—Emulsion of Cod Liver Oil made with Quillaja should not be dispensed without the direction or consent of the prescriber.

V. Dextrin Emulsion of Cod Liver Oil. *N. F.*

Cod Liver Oil,	8 fl. oz.
Mucilage of Dextrin (N. F.),	5 fl. oz.
Syrup of Tolu,	2 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

To the Mucilage of Dextrin, contained in a suitable bottle, add the Cod Liver Oil, first in small portions, agitating each time, until the last-added portion is emulsified. Then add the Flavoring, the Syrup of

Tolu, and, lastly, enough Water to make *sixteen* (16) *fluidounces*, and mix the whole thoroughly together.

Flavoring.—Since no single or compound aromatic can be devised which would be acceptable under all circumstances as a flavoring for Emulsion of Cod Liver Oil, the selection of the most suitable aromatic must be left to the prescriber or dispenser. Among those which are found to be most generally serviceable are the following, the quantities given below being intended for *one* (1) *pint* of finished emulsion, though in some cases a smaller or a larger quantity, in the same proportions, may be preferable:

1. Oil of Gaultheria,	30 min.
2. Oil of Gaultheria,	15 min.
Oil of Sassafras,	15 min.
3. Aromatic Spirit (N. F.),	120 min.
4. Oil of Gaultheria,	15 min.
Oil of Bitter Almond,	2 min.
Oil of Coriander,	2 min.
5. Oil of Gaultheria,	10 min.
Oil of Sassafras,	10 min.
Oil of Bitter Almond,	2 min.
6. Oil of Gaultheria,	20 min.
Oil of Bitter Almond,	20 min.
7. Oil of Neroli,	12 min.
Oil of Bitter Almond,	12 min.
Oil of Cloves,	2 min.

117. Emulsio Olei Morrhuæ cum Calcii Phosphate. *N. F.*

Emulsion of Cod Liver Oil with Phosphate of Calcium.

Emulsion of Cod Liver Oil with Phosphate of Lime.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Phosphate of Calcium,	256 gr.
Syrup of Tolu,	1 fl. oz.
Alcohol,	1 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

To the Mucilage of Chondrus, contained in a suitable vessel, gradually add the Cod Liver Oil, and prepare an emulsion as directed under *Emulsio Olei Morrhuæ*. Triturate the Phosphate of Calcium with the Syrup of Tolu and add this to the emulsion; then add the Alcohol, Flavoring, and enough Water to make *sixteen* (16) *fluidounces*. Mix the whole thoroughly together.

Note.—If any other method of emulsifying the oil is adopted, the Phosphate of Calcium should be triturated with Water, or some other of the liquid constituents, which are added last. A very good emulsion can be made by using mucilage of dextrin.

118. Emulsio Olei Morrhuæ cum Extracto Malti. *N. F.*

Emulsion of Cod Liver Oil with Extract of Malt.

Cod Liver Oil,	8 fl. oz.
Mucilage of Dextrin (N. F.),	2 fl. oz.
Extract of Malt,	6 fl. oz.

To the Mucilage of Dextrin, contained in a suitable bottle, add the Extract of Malt, and mix them thoroughly by agitation. Then gradually add the Cod Liver Oil, first in small portions, agitating each time until the last-added portion is perfectly incorporated.

Note.—Extract of Malt, most suitable for this preparation, should have about the same consistence as Balsam of Peru, at a temperature of 15° C. (59° F.).

119. Emulsio Olei Morrhuæ cum Hypophosphite. *N. F.*

Emulsion of Cod Liver Oil with Hypophosphite.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Any Soluble Hypophosphite,	128 gr.
Syrup of Tolu,	1 fl. oz.
Alcohol,	1 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Dissolve the Hypophosphite in the Mucilage of Chondrus, and emulsify the Cod Liver Oil with the latter as directed under *Emulsio Olei Morrhuæ*. Then add the Syrup of Tolu, Alcohol, and Flavoring, and, finally, enough Water to make *sixteen* (16) *fluidounces*. Mix the whole thoroughly together.

Note.—If another method of emulsifying the oil is adopted, the Hypophosphite should be dissolved in the aqueous portion of the mixture.

If more than one Hypophosphite is directed in combination with Emulsion of Cod Liver Oil, and no definite quantities of the salts are prescribed, equal parts of the several Hypophosphites may be taken, amounting altogether to 128 grains for every pint of emulsion.

116. Emulsio Olei Morrhuæ cum Calcii Lactophosphate. *N. F.*

Emulsion of Cod Liver Oil with Lactophosphate of Calcium.

Emulsion of Cod Liver Oil with Lactophosphate of Lime.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Lactate of Calcium,	256 gr.
Phosphoric Acid (50 per cent.),	256 min.
Syrup of Tolu,	1 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

To the Mucilage of Chondrus, contained in a suitable bottle, gradually add the Cod Liver Oil, and emulsify the latter as directed under *Emulsio Olei Morrhuæ*. Dissolve the Lactate of Calcium in *one* (1) *fluidounce* of Water with the aid of the Phosphoric Acid, add the solution gradually to the emulsion, then the syrup of Tolu, the Flavoring, and, lastly, enough Water to make *sixteen* (16) *fluidounces*. Mix the whole thoroughly together.

This emulsion should be freshly prepared when wanted for use.

Note.—If any other method of emulsifying the oil is adopted, the solution of Lactophosphate of Calcium should be made to replace an equivalent volume of the aqueous portion of the emulsion. A very good emulsion can be made by using mucilage of dextrin.

120. Emulsio Olei Morrhuæ cum Pruno Virginiana. *N. F.*

Emulsion of Cod Liver Oil with Wild Cherry.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Fluid Extract of Wild Cherry,	1 fl. oz.
Syrup of Tolu,	1 fl. oz.
Alcohol,	½ fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

To the Mucilage of Chondrus, contained in a suitable bottle, gradually add the Cod Liver Oil, and prepare an emulsion as directed under *Emulsio Olei Morrhuæ*. Next add the Fluid Extract of Wild Cherry, then the Syrup of Tolu, Alcohol, Flavoring, and enough Water to make *sixteen* (16) *fluidounces*.

Note.—If another method of emulsifying the oil is adopted, the Fluid Extract of Wild Cherry is to be added after the emulsion of the oil is accomplished, if necessary, with omission of a corresponding volume of one of the secondary constituents.

123. Emulsio Phosphatica. *N. F.*

Phosphatic Emulsion.

Mistura Phosphatica.

Cod Liver Oil,	4 fl. oz.
Glycerite of Yolk of Egg (U. S. P.),	2½ tr. oz.
Diluted Phosphoric Acid,	360 min.
Oil of Bitter Almond,	10 min.
Rum, Jamaica,	4 fl. oz.
Orange Flower Water,	enough to make 16 fl. oz.

To the Glycerite of Yolk of Egg (Glyconin), contained in a suitable bottle, gradually add the Cod Liver Oil, in small portions at a time, shaking after each addition, until the added portion is emulsified. Then gradually add the Phosphoric Acid, Rum, and Oil of Bitter Almond, incorporating them thoroughly. Finally, add enough Orange Flower Water to make *sixteen* (16) *fluidounces*, and mix the whole thoroughly together.

115. Emulsio Olei Morrhuæ cum Calcii et Sodii Phosphatibus. *N. F.*

Emulsion of Cod Liver Oil with Phosphates of Calcium and Sodium.

Emulsion of Cod Liver Oil with Phosphates of Lime and Soda.

Cod Liver Oil,	8 fl. oz.
Mucilage of Chondrus (N. F.),	5 fl. oz.
Phosphate of Calcium,	128 gr.
Phosphate of Sodium,	128 gr.
Syrup of Tolu,	1 fl. oz.
Alcohol,	1 fl. oz.
Flavoring,	a sufficient quantity.
Water,	enough to make 16 fl. oz.

Dissolve the Phosphate of Sodium in the Mucilage of Chondrus, and emulsify the Cod Liver Oil, with the latter, as directed under *Emulsio Olei Morrhuæ*. Then triturate the Phosphate of Calcium with the Syrup of Tolu, add the mixture to the emulsion, afterwards add the Alcohol and Flavoring, and, finally, enough Water to make *sixteen* (16)) *fluidounces*. Mix the whole thoroughly together.

Note.—If another method of emulsifying the oil is adopted, the Phosphate of Sodium should be dissolved in the aqueous portion of the mixture, and the Phosphate of Calcium incorporated mechanically. A very good emulsion can be made by using mucilage of dextrin.

193. Lac Fermentatum. *N. F.*

Fermented Milk.

Kumyss.

Cow's Milk, fresh,	32 fl. oz.
Yeast, semi-liquid,	60 min.
Sugar,	1 tr. oz.

Dissolve the Sugar in the Milk, contained in a strong bottle, add the Yeast, cork the bottle securely, and keep it at a temperature between 23° and 32° C. (75° to 90° F.) for six hours; then transfer it to a cold place.

426. Vinum Carnis. *N. F.*

Wine of Beef.

Beef and Wine.

Extract of Beef,	256 gr.
Hot Water,	1 fl. oz.
Sherry Wine,	enough to make 16 fl. oz.

Pour the Hot Water upon the Extract of Beef contained in a mortar or other suitable vessel, and triturate until a smooth mixture results. Then gradually add, while stirring, *fourteen* (14) *fluidounces* of Sherry Wine. Transfer the mixture to a bottle, set this aside for a few days in a cold place, if convenient, then filter, and pass enough Sherry Wine through the filter to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents 2 grains of Extract of Beef.

Note.—The Extract of Beef suitable for this or similar preparations is that which is prepared by Liebig's method.

427. Vinum Carnis et Ferri. *N. F.*

Wine of Beef and Iron.

Beef, Wine, and Iron.

Extract of Beef,	256 gr.
Tincture of Citro-Chloride of Iron,	256 min.
Hot Water,	1 fl. oz.
Sherry Wine,	enough to make 16 fl. oz.

Pour the Hot Water upon the Extract of Beef contained in a mortar or other suitable vessel, and triturate until a smooth mixture results. Then gradually add, while stirring, *twelve* (12) *fluidounces* of Sherry Wine. Next add the Tincture

and enough Sherry Wine to make *sixteen* (16) *fluidounces*. Transfer the mixture to a bottle, set this aside for a few days in a cold place, if convenient, filter, and pass enough Sherry Wine through the filter to restore the original volume.

Each fluidrachm represents 2 grains of Extract of Beef and 2 minims of Tincture of Citro-Chloride of Iron.

Note.—Regarding Extract of Beef, see *Note* to No. 426, page 1244.

428. Vinum Carnis, Ferri, et Cinchonæ. *N. F.*

Wine of Beef, Iron, and Cinchona.

Beef, Wine, Iron, and Cinchona.

Extract of Beef,	256 gr.
Tincture of Citro-Chloride of Iron,	256 min.
Sulphate of Quinine,	16 gr.
Sulphate of Cinchonidine,	8 gr.
Citric Acid,	6 gr.
Hot Water,	1 fl. oz.
Angelica Wine, enough to make	16 fl. oz.

Dissolve the Citric Acid and the Sulphates of Quinine and Cinchonidine in the Hot Water, and pour the solution upon the Extract of Beef contained in a mortar or other suitable vessel. Triturate the liquid with the Extract until they form a smooth mixture, then gradually add, while stirring, *twelve* (12) *fluidounces* of Angelica Wine, and afterwards the Tincture of Citro-Chloride of Iron. Transfer the mixture to a bottle, set this aside for a few days in a cold place, if convenient, filter, and pass enough Angelica Wine through the filter to make *sixteen* (16) *fluidounces*.

Each fluidrachm represents 2 grains of Extract of Beef, 2 minims of Tincture of Citro-Chloride of Iron, and small quantities of Cinchona alkaloids.

Note.—Regarding Extract of Beef, see *Note* to No. 426, page 1244. Angelica Wine is a variety of sweet California wine.

233. Liquor Seriparus. *N. F.*

Liquid Rennet.

Calves' Rennet, fresh,	2 tr. oz.
Chloride of Sodium,	360 gr.
Alcohol,	4 fl. oz.
Water,	16 fl. oz.

Dissolve the Chloride of Sodium in the Water, add the Alcohol, and macerate in this mixture the Rennet (or the washed mucous membrane of the fresh stomach of a suckling calf), during three days, under frequent agitation. Then filter.

Note.—If this liquid is to be used merely for curdling the milk, without separating the whey as a distinct layer, it should be added to the milk, previously warmed to a temperature of about 35° C. (95° F.), and the mixture should then be set aside, undisturbed, until it coagulates. If the whey is to be separated, the Liquid Rennet should be added to the milk while cold, and the mixture heated to about 35° C. (95° F.), but not exceeding 40° C. (104° F.). One part of the liquid should coagulate between 200 and 300 parts of milk.

210. Liquor Carmini. *N. F.*

Solution of Carmine.

Carmine,	1 tr. oz.
Water of Ammonia,	6 fl. oz.
Glycerin,	6 fl. oz.
Water, enough to make	16 fl. oz.

Triturate the Carmine to a fine powder in a Wedgwood mortar, gradually add the Water of Ammonia, and afterwards the Glycerin, under constant trituration. Transfer the mixture to a porcelain capsule, and heat it upon a water-bath, constantly stirring, until the liquid is entirely free from ammoniacal odor. Then cool, and add enough Water to make *sixteen* (16) *fluidounces*.

Note.—The best quality of Carmine, known in commerce as "No. 40," should be used for this preparation.

211. Liquor Coccineus. *N. F.*

Cochineal Color.

Cochineal, in No. 50 powder,	1 tr. oz.
Carbonate of Potassium,	¼ tr. oz.
Alum,	¼ tr. oz.
Bitartrate of Potassium,	1 tr. oz.
Glycerin,	8 fl. oz.
Alcohol,	1 fl. oz.
Water, enough to make	16 fl. oz.

Triturate the Cochineal intimately with the Carbonate of Potassium and *eight* (8) *fluidounces* of Water. Then add the Alum and Bitartrate of Potassium successively, heat the mixture to boiling in a capacious vessel, then set it aside to cool, add to it the Glycerin and Alcohol, filter, and pass enough Water through the filter to make *sixteen* (16) *fluidounces*.

335. Spiritus Acidi Formici. *N. F.*

Spirit of Formic Acid.

Spiritus Formicarum (*Germ. Pharm.*). Spirit of Ants.

Formic Acid,	250 min.
Distilled Water,	3½ fl. oz.
Alcohol, enough to make	16 fl. oz.

Mix the Formic Acid with the Distilled Water, and add enough Alcohol to make *sixteen* (16) *fluidounces*.

Note.—Formic Acid is required by the Germ. Pharm. to have a specific gravity of 1·060 to 1·063.

347. Spongia Compressa. *N. F.*

Compressed Sponge.

Sponge Tent.

Sponge,	a sufficient quantity.
Mucilage of Acacia,	1 volume.
Water,	9 volumes.

Mix a sufficient quantity of Mucilage of Acacia and of Water, in the proportion of

one (1) *volume* of the former to *nine* (9) *volumes* of the latter, and immerse in the liquid the Sponge, previously freed from sand and other obvious impurities, and cut into suitable pieces. When the Sponge has been thoroughly impregnated, firmly wrap twine around it so as to bring it to the desired shape, and then dry it.

Note.—Sponge thus prepared is best preserved with the twine wrapped around it. If the twine is removed, special care must be taken to protect the Sponge against damp air.

348. Spongia Decolorata. *N. F.*

Decolorized Sponge.

Bleached Sponge.

Sponge,	
Permanganate of Potassium,	
Hyposulphite of Sodium,	
Hydrochloric Acid,	
Water, each,	a sufficient quantity.

Free the Sponge from sand and any other obvious impurities or damaged portions by beating, washing, and trimming, then soak it for about fifteen minutes in a sufficient quantity of solution of Permanganate of Potassium, containing *one hundred and twenty* (120) *grains* to the *pint*, wringing the Sponge out occasionally and replacing it in the liquid. Then remove it and wash it with Water, until the latter runs off colorless. Wring out the Water, and then place the Sponge into a solution of Hyposulphite of Sodium containing *one* (1) *troyounce* to the *pint*. Next add for every *pint* of the last-named solution used, *one* (1) *fluidounce* of Hydrochloric Acid diluted with *four* (4) *fluidounces* of Water. Macerate the Sponge in the liquid for about fifteen minutes, expressing it frequently, and replacing it in the liquid. Then remove it, wash it thoroughly with Water, and dry it. In the case of large and dark-colored sponges, this treatment may be repeated until the color has been removed as far as possible.

Note.—If it is desired to keep the Sponge soft, and to prevent it from shrinking when dry, it may be dipped, after having been finally washed, into a mixture of 1 volume of Glycerin and 5 volumes of Water, after which it is to be wrung out and allowed to dry.

Ethereal Tincture of Cantharides.

Cantharides,	1 oz. (troy).
Spirit of Nitrous Ether,	14 fl. oz.

Macerate for eight days, and filter.

Hair Tonic.

(Prof. Gross.)

Tincture of Cantharides,	90 min.
Tincture of Capsicum,	20 min.
Glycerin,	80 min.
Perfumed Spirit, sufficient to make	6 fl. oz.

Mix.

Unguentum Cantharidis. *U. S.* 1870.

OINTMENT OF CANTHARIDES.

Cantharides,	
Yellow Wax, of each,	1 oz. (av.).
Olive Oil,	6 fl. oz.

Infuse the Cantharides in the Oil in a covered vessel for twelve hours; then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the Wax, previously melted, and stir constantly while the mixture cools.

Antispasmodic Mixture.

(Sydenham's.)

Tincture of Valerian,	5 fl. dr.
Compound Spirit of Ether,	1 fl. dr.
Tincture of Castor,	10 fl. dr.
Fennel Water,	12½ fl. oz.

Mix. Dose, a tablespoonful every three or four hours.

Tinctura Castorei. *U. S.* 1870.

TINCTURE OF CASTOR.

Castor (bruised),	1 oz. (troy).
Alcohol,	16 fl. oz.

Macerate for seven days, express, and filter through paper.

SODA-WATER SYRUPS.

Vanilla Syrup.

Fluid Extract of Vanilla,	2 fl. oz.
Syrup, a sufficient quantity to make	32 fl. oz.

Mix.

Ginger Syrup.

Tincture of Ginger,	4 fl. oz.
Syrup, a sufficient quantity to make	128 fl. oz.

Mix.

Lemon Syrup.

Solution of Citric Acid (1 in 10),	3 fl. oz.
Spirit of Lemon,	1½ fl. oz.
Syrup,	8 pints.
Tincture of Curcuma, a sufficient quantity to color.	

Mix.

Syrup of Sarsaparilla.

Fluid Extract of Sarsaparilla,	2 fl. oz.
Oil of Sassafras,	
Oil of Anise, of each,	12 min.
Oil of Gaultheria,	9 min.
Syrup, a sufficient quantity to make	8 pints.

Mix.

Orange Syrup.

Oil of Orange (fresh),	10 min.
Citric Acid,	120 gr.
Syrup,	64 fl. oz.

Mix.

Strawberry Syrup.

Strawberry Juice,	32 fl. oz.
Sugar,	128 oz. (av.).
Water,	32 fl. oz.

Mix the Juice and Water, and dissolve the Sugar by percolating with the mixture.

Raspberry Syrup.

Raspberry Juice,	32 fl. oz.
Sugar,	128 oz. (av.).
Water,	32 fl. oz.

Mix the Juice and Water, and dissolve the Sugar by percolating with the mixture.

Pineapple Syrup.

Pineapple Juice,	32 fl. oz.
Sugar,	128 oz. (av.).
Water,	32 fl. oz.

Mix the Juice and Water, and dissolve the Sugar by percolating with the mixture.

Nectar Syrup.

Vanilla Syrup,	40 fl. oz.
Pineapple Syrup,	8 fl. oz.
Strawberry Syrup,	16 fl. oz.

Mix.

Chocolate Syrup.

Best Chocolate,	8 oz. (av.).
Sugar,	64 oz. (av.).
Water,	32 fl. oz.

Mix the Chocolate in the Water, and stir thoroughly over a slow fire; strain, and add the Sugar.

Sherbet Syrup.

Vanilla Syrup,	48 fl. oz.
Pineapple Syrup,	16 fl. oz.
Lemon Syrup,	16 fl. oz.

Mix.

Coffee Syrup.

Coffee (roasted),	8 oz. (av.).
Boiling Water,	8 pints.
Sugar,	112 oz. (av.).

Make an infusion, filter, add the Sugar, and strain.

COLORS FOR SHOW-BOTTLES.

Dark Blue.

Copper Nitrate,	4 oz. (av.).
Water,	16 pints.

Water of Ammonia, a sufficient quantity.

Dissolve the Copper salt, add Ammonia as long as it deepens the color; filter.

Dark Green.

Copper Sulphate,	8 oz. (av.).
Potassium Bichromate,	60 gr.
Water,	16 pints.

Mix, and filter.

Red.

Fuchsine,	20 gr.
Acetic Acid,	2 fl. oz.
Water,	8 pints.

Mix.

Yellow.

Potassium Bichromate,	4 oz. (av.).
Nitric Acid,	4 fl. oz.
Water,	16 pints.

Mix, and filter.

PREPARATIONS OF THE U.S.P. 1880 NOT ADMITTED TO THE U.S.P. 1890.

THIS list of preparations has been appended on account of the occasional call for such formulas, and because many of them possess decided merit and will no doubt be used for years to come. One advantage in grouping such by themselves is that the dismissed preparations can all be seen together, and this will aid the student in determining their character. The dismissed chemical salts will be found in the lists of unofficial substances at the beginning of the various chapters.

Abstracts.

The abstracts, with their formulas, will be found on page 458.

Acetum Lobeliæ. U. S. 1880. *Vinegar of Lobelia.*

	By measure.
Lobelia, in No. 80 powder, 10 parts, or	1¾ oz. av.
Diluted Acetic Acid, a sufficient quantity,	
To make 100 parts, or	1 pint.

Moisten the powder with 5 parts [or 1 fl. oz.] of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour Diluted Acetic Acid upon it until 100 parts [or 1 pint] of filtered liquid are obtained.

Acetum Sanguinariæ. U. S. 1880. *Vinegar of Sanguinaria.*

	By measure.
Sanguinaria, in No. 80 powder, 10 parts, or	1¾ oz. av.
Diluted Acetic Acid, a sufficient quantity,	
To make 100 parts, or	1 pint.

Moisten the powder with 5 parts [or 1 fl. oz.] of Diluted Acetic Acid, pack it firmly in a conical glass percolator, and gradually pour Diluted Acetic Acid upon it until 100 parts [or 1 pint] of filtered liquid are obtained.

Amylum Iodatum. U. S. 1880. *Iodized Starch.*

Starch, 95 parts, or	418 grains.
Iodine, 5 parts, or	22 grains.
Distilled Water, a sufficient quantity,	
To make 100 parts, or about	1 oz. av.

Triturate the Iodine with a little Distilled Water; add the Starch gradually and continue triturating until the compound assumes a uniform blue color, approaching black. Dry it at a temperature not exceeding 40° C. (104° F.) and rub it to a fine powder.

Ceratum Extracti Cantharidis. U. S. 1880. *Cerate of Extract of Cantharides.*

	By measure.
Cantharides, in No. 60 powder, 30 parts, or	6 oz. av.
Resin, 15 parts, or	3 oz. av.
Yellow Wax, 35 parts, or	7 oz. av.
Lard, 35 parts, or	7 oz. av.
Alcohol, a sufficient quantity.	

Moisten the Cantharides with 18 parts [or 4 fl. oz.] of Alcohol, and pack firmly in a cylindrical percolator; then gradually pour on Alcohol, until 180 parts [or 2¼ pints] of percolate are obtained, or until the Cantharides are exhausted. Distil off the Alcohol by means of a water-bath, transfer the residue to a tared capsule and evaporate it, on a water-bath, until it weighs 15 parts [or 3 oz. av.]. Add to this the Resin, Wax, and Lard, previously melted together, and keep the whole at a temperature of 100° C. (212° F.) for 15 minutes. Lastly, strain the mixture through muslin, and stir it constantly until cool.

Ceratum Sabinæ. U. S. 1880. *Savine Cerate.*

	By measure.
Fluid Extract of Savine, 25 parts, or	5 oz. av.
Resin Cerate, 90 parts, or	18 oz. av.

Melt the Resin Cerate by means of a water-bath, add the Fluid Extract of Savine, and continue the heat until the alco-

hol has evaporated; then remove the heat, and stir constantly until cool.

Charta Cantharidis. U. S. 1880. *Cantharides Paper.*

White Wax, 8 parts, or	4 oz. av.
Spermaceti, 3 parts, or	1½ oz. av.
Olive Oil, 4 parts, or	2 fl. oz.
Canada Turpentine, 1 part, or	½ oz. av.
Cantharides, in No. 40 powder, 1 part, or	½ oz. av.
Water, 10 parts, or	5 fl. oz.

Mix all the substances in a tinned vessel, and boil gently for two hours, constantly stirring. Strain through a woollen strainer without expressing, and, by means of a water-bath, keep the mixture in a liquid state in a shallow, flat-bottomed vessel with an extended surface. Coat strips of sized paper with the melted plaster, on one side only, by passing them successively over the surface of the liquid; when dry, cut the strips into rectangular pieces.

Elixir Aurantii. U. S. 1880. *Elixir of Orange.* [Simple Elixir.]

Oil of Orange Peel, 1 part, or	2½ fl. dr.
Cotton, 2 parts, or	4 dr.
Sugar, in coarse powder, 100 parts, or	25 oz. av.
Alcohol,	
Water, each, a sufficient quantity,	
To make 800 parts, or about	4 pints.

Mix Alcohol and Water in the proportion of one part [or 1 pint] of Alcohol to 8 parts [or 2½ pints] of Water. Add the Oil of Orange Peel to the Cotton, in small portions at a time, distributing it thoroughly by picking the cotton apart after each addition; then pack tightly in a conical percolator, and gradually pour on the mixture of Alcohol and Water, until 200 parts (or 3½ pints) of filtered liquid are obtained. In this liquid dissolve the sugar by agitation, without heat, and strain.

Emplastrum Ammoniaci. U. S. 1880. *Ammoniac Plaster.*

Ammoniac, 100 parts, or	5 oz. av.
Diluted Acetic Acid, 140 parts, or	½ pint.

Digest the Ammoniac in the Diluted Acetic Acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsionized; then strain, and evaporate the strained liquid, by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling.

Emplastrum Asafoetidae. U. S. 1880. *Asafetida Plaster.*

Asafetida, 35 parts, or	18 oz. av.
Lead Plaster, 35 parts, or	18 oz. av.
Galbanum, 15 parts, or	5½ oz. av.
Yellow Wax, 15 parts, or	5½ oz. av
Alcohol, 120 parts, or	8 pints.

Digest the Asafetida and Galbanum with the Alcohol on a water-bath, separate the liquid portion, while hot, from the coarser impurities by straining, and evaporate it to the consistence of honey; then add the Lead Plaster and the Wax, previously melted together, stir the mixture well, and evaporate to the proper consistence.

Emplastrum Galbani. U. S. 1880. *Galbanum Plaster.*

Galbanum, 16 parts, or	8 oz. av.
Turpentine, 2 parts, or	1 oz. av.
Burgundy Pitch, 6 parts, or	3 oz. av.
Lead Plaster, 76 parts, or	38 oz. av.
To make 100 parts, or	50 oz. av.

To the Galbanum and Turpentine, previously melted together and strained, add, first, the Burgundy Pitch, then the Lead Plaster, melted over a gentle fire, and mix the whole thoroughly.

Emplastrum Picis Canadensis. U. S. 1880. *Canada Pitch Plaster.* [Hemlock Pitch Plaster.]

Canada Pitch, 90 parts, or	9 oz. av.
Yellow Wax, 10 parts, or	1 oz. av.
To make 100 parts, or	10 oz. av.

Melt them together, strain the mixture, and stir constantly until it thickens on cooling.

Extractum Cornus Fluidum. U. S. 1880. *Fluid Extract of Cornus.*

Cornus, in No. 60 powder, 100 grammes, or	50 oz. av.
Glycerin, 20 grammes, or	7½ fl. oz.
Diluted Alcohol, a sufficient quantity,	
To make 100 cubic centimeters, or	3 pints.

Mix the Glycerin with 80 Gm. [or 41 fl. oz.] of Diluted Alcohol. Moisten the powder with 30 Gm. [or 15 fl. oz.] of the mixture, and pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours Then allow the percolation to proceed, gradually adding, first, the re-

mainder of the menstruum, and afterward, Diluted Alcohol, until the Cornus is exhausted. Reserve the first 85 C.c. [or 40 fl. oz.] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough Diluted Alcohol to make the Fluid Extract measure 100 C.c. [or 8 pints].

Extractum Lactucarii Fluidum. U. S. 1880. *Fluid Extract of Lactucarium.*

Lactucarium, in coarse pieces, 100 Gm., or	12½ oz. av.
Ether, 100 Gm., or	1 pint.
Alcohol,	
Water, each, a sufficient quantity,	
To make 100 C.c., or	12 fl. oz.

Add the Lactucarium to the Ether contained in a tared flask having the capacity of 600 C.c. [or about 4½ pints], and let it macerate for 24 hours; then add 300 Gm. [or 2½ pints] of Water, and shake the mixture well. Fit a bent glass tube into the neck of the flask, and, having immersed the flask in hot water, recover the Ether by distillation. When all the Ether has distilled over, remove the tube, and, after thoroughly shaking the contents of the flask, continue the heat for half an hour. Let the mixture cool, add 100 Gm. [or 14½ fl. oz.] of Alcohol, and enough Water to make the whole mixture weigh 500 Gm. [or 64 oz. av.]; after maceration for 24 hours, with occasional agitation, express and filter the liquid. Return the dregs to the flask and macerate them with 200 Gm. [or 28 fl. oz.] of a mixture of Alcohol and Water made in the proportion of 1 part [or 8 fl. oz.] of Alcohol to 3 parts [or 20 fl. oz.] of Water; repeat the maceration 2 or 3 times, successively, with fresh portions of the mixture, until the dregs are tasteless, or nearly so. Mix, and filter the liquids thus obtained, and concentrate them, by means of a water-bath (the first expressed liquid by itself), until the combined weight of the liquids is 60 Gm. [or 7½ oz. av.]; mix the liquids, add 40 Gm. [or 6 fl. oz.] of Alcohol, and let the mixture cool in the evaporating vessel, stirring the mixture frequently, and during the intervals keeping the vessel well covered. When cool, add enough Alcohol to make the mixture weigh 100 Gm. [or 12½ oz. av.], transfer the liquid to a flask, and add enough Water to make the mixture measure 100 C.c. [or 12 fl. oz.], using the Water so required to rinse the evaporating vessel. Shake the mixture occasionally, during several hours (and frequently, if a portion of the precipitate is found to be tenacious), and, when a uniform mixture results, set it aside for 24 hours, so that any precipitate formed may subside. Decant the clear liquid, transfer the precipitate to a filter, and, after thoroughly draining it into the decanted liquid, wash it with a mixture of Alcohol and Water made in the proportion of 3 parts [or 10 fl. dr.] of Alcohol to 4 parts [or 11 fl. dr.] of Water, until the washings pass tasteless. Concentrate the washings, by evaporation, to a syrupy consistence, mix with the decanted liquid, and add enough of the last-named mixture of Alcohol and Water to make the whole measure 100 C.c. [or 12 fl. oz.]. Lastly, after 24 hours, having meanwhile shaken the Fluid Extract occasionally, filter it through paper.

Extractum Malti. U. S. 1880. *Extract of Malt.*

Malt, in coarse powder, not finer than No. 12, 100 parts, or	80 oz. av.
Water, a sufficient quantity.	

Upon the powder, contained in a suitable vessel, pour 100 parts [or 5 pints] of Water, and macerate for 6 hours. Then add 400 parts [or 20 pints] of Water, heated to about 30° C. (86° F.), and digest for an hour at a temperature not exceeding 55° C. (131° F.). Strain the mixture with strong expression. Finally, by means of a water-bath, or vacuum-apparatus, at a temperature not exceeding 55° C. (131° F.), evaporate the strained liquid rapidly to the consistence of thick honey. Keep the product in well-closed vessels, in a cool place.

Extractum Mezerei. U. S. 1880. *Extract of Mezereum.*

Mezereum, in No. 30 powder, 100 parts, or	16 oz. av.
Alcohol, a sufficient quantity.	

Moisten the powder with 40 parts [or 6 fl. oz.] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding Alcohol, until 800 parts [or 8 pints] of tincture are obtained, or the Mezereum is exhausted. Reserve the first 90 parts [or 13 fl. oz.] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.) to 10 parts [or 2 fl. oz.]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, in a porcelain capsule, on a water-bath, to a pilular consistence.

Fel Bovis Inspissatum. U. S. 1880. *Inspissated Ox Gall.*

Fresh Ox Gall, 3 parts, or	16 oz. av.
Alcohol, 1 part, or	6 fl. oz.

Evaporate the Ox Gall in a porcelain capsule, on a water-bath, to 1 part [or 5½ oz. av.], then add to it the Alcohol, agitate the mixture thoroughly, and let it stand, well covered, for 24 hours. Decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the Alcohol, evaporate to a pilular consistence. (See Fel Bovis Purificatum.)

Infusum Brayeræ. U. S. 1880. *Infusion of Brayera.*

Brayera, in No. 20 powder, 6 parts, or	1 oz. av.
Boiling Water, 100 parts, or	1 pint.

Pour the Boiling Water upon the Brayera, and let it macerate in a covered vessel until cool. This infusion should be dispensed without straining.

Linimentum Cantharidis. U. S. 1880. *Cantharides Liniment.*

Cantharides, in No. 60 powder, 15 parts, or	1 oz. av.
Oil of Turpentine, a sufficient quantity, or	8 fl. oz.
To make 100 parts, or	½ pint.

Digest the Cantharides with 100 parts [or ½ pint] of Oil of Turpentine, in a closed vessel, by means of a water-bath, for 3 hours; then strain and add enough Oil of Turpentine through the strainer to make the Liniment weigh 100 parts [or measure ½ pint].

Linimentum Plumbi Subacetatis. U. S. 1880. *Liniment of Subacetate of Lead.*

Solution of Subacetate of Lead, 40 parts, or	2 oz. av.
Cotton Seed Oil, 60 parts, or	3 oz. av.
To make 100 parts, or	5 oz. av.

Mix them.

Liquor Ferri et Quininæ Citratis. U. S. 1880. *Solution of Citrate of Iron and Quinine.*

Citrate of Iron and Ammonium, 65 parts, or	568 grains.
Quinine, dried at 100° C. (212° F.), until it ceases to lose weight, 12 parts, or	105 grains.
Citric Acid, 28 parts, or	245 grains.
Alcohol, 30 parts, or	6 fl. dr.
Distilled Water, a sufficient quantity,	
To make 200 parts, or	4 oz. av.

Dissolve the Citrate of Iron and Ammonium in 200 parts (or 4 fl. oz.) of Distilled Water, contained in a tared porcelain capsule, heat the solution to 60° C. (140° F.) on a water-bath, add the Citric Acid, and, when it is dissolved, add the Quinine, stirring the mixture until a perfect solution has been obtained. Evaporate this to 160 parts (or 3 oz. av.), allow it to cool, add the Alcohol, and finally enough Distilled Water to make the solution weigh 200 parts (or 4 oz. av.).

Liquor Gutta-Perchæ. U. S. 1880. *Solution of Gutta-Percha.*

Gutta-Percha, in thin slices, nine parts,	9
Commercial Chloroform, ninety-one parts,	91
Carbonate of Lead, in fine powder, ten parts,	10
To make one hundred parts,	100

Add the Gutta-Percha to 70 parts of the Chloroform, contained in a bottle, cork it well, and shake it occasionally until the Gutta-Percha is dissolved. Then add the Carbonate of Lead, previously mixed with the remainder of the Chloroform, and, having several times shaken the whole together, at intervals of half an hour, set the mixture aside until the insoluble matters have subsided and the solution has become perfectly clear. Lastly, decant the liquid and preserve it in small, cork-stoppered bottles.

Liquor Pepsini. U. S. 1880. *Solution of Pepsin.* [Liquid Pepsin.]

Saccharated Pepsin, 40 parts, or	400 grains.
Hydrochloric Acid, 12 parts, or	100 minims.
Glycerin, 400 parts, or	7 fl. oz.
Water, 548 parts, or	12 fl. oz.
To make 1000 parts, or about	20 fl. oz.

Dissolve the Saccharated Pepsin in the Water, previously mixed with the Hydrochloric Acid, add the Glycerin, let the mixture stand 24 hours, and filter.

Mistura Magnesiæ et Asafœtidæ. U. S. 1880. *Mixture of Magnesia and Asafetida.* [Dewees' Carminative.]

Carbonate of Magnesium, 5 parts, or	360 grains.
Tincture of Asafetida, 7 parts, or	10 fl. dr.
Tincture of Opium, 1 part, or	75 minims.
Sugar, 10 parts, or	1½ oz. av.
Distilled Water, a sufficient quantity,	
To make 100 parts, or about	1 pint.

Rub the Carbonate of Magnesium and Sugar in a mortar, with the Tincture of Asafetida and Tincture of Opium. Then gradually add enough Distilled Water to make the mixture weigh 100 parts [or measure 16 fl. oz.].

Mistura Potassii Citratis. U. S. 1880. *Mixture of Citrate of Potassium.* [Neutral Mixture.]

Fresh Lemon Juice, strained, 100 parts, or	4 fl. oz.
Bicarbonate of Potassium, about 10 parts, or a sufficient quantity,	170 grains.

Add the Bicarbonate of Potassium gradually to the Lemon Juice until it is neutralized.

This preparation should be freshly made, when wanted for use.

Mucilago Cydonii. U. S. 1880. *Mucilage of Cydonium.*

Cydonium, 2 parts, or	36 grains.
Distilled Water, 100 parts, or	4 fl. oz.

Macerate the Cydonium for half an hour, in a covered vessel, with the Distilled Water, frequently agitating. Then drain the liquid through muslin, without pressure. This preparation should be freshly made, when required for use.

Pilulæ Ferri Compositæ. U. S. 1880. *Compound Pills of Iron.*

	Grains.	Grammes.
Myrrh, in fine powder, one hundred and fifty grains,	150	9.75
Carbonate of Sodium, seventy-five grains,	75	4.85
Sulphate of Iron, seventy-five grains,	75	4.85
Syrup, a sufficient quantity,		
	300	19.45
To make one hundred pills,	100	

Pilulæ Galbani Compositæ U. S. 1880. *Compound Pills of Galbanum.*

	Grains.	Grammes.
Galbanum, one hundred and fifty grains,	150	9.75
Myrrh, one hundred and fifty grains,	150	9.75
Asafetida, fifty grains,	50	3.25
Syrup, a sufficient quantity,		
	350	22.75
To make one hundred pills,	100	

Spiritus Odoratus. U. S. 1880. *Perfumed Spirit.* [Cologne Water.]

Oil of Bergamot, 16 parts, or	2 fl. oz.
Oil of Lemon, 8 parts, or	1 fl. oz.
Oil of Rosemary, 8 parts, or	1 fl. oz.
Oil of Lavender Flowers, 4 parts, or	½ fl. oz.
Oil of Orange Flowers, 4 parts, or	½ fl. oz.
Acetic Ether, 2 parts, or	2 fl. dr.
Water, 158 parts, or	18 fl. oz.
Alcohol, 800 parts, or	6½ pints.
To make 1000 parts, or about	8 pints.

Dissolve the Oils and the Acetic Ether in the Alcohol, and add the Water. Set the mixture aside, in a well-closed bottle, for eight days, then filter through paper, in a well-covered funnel.

Syrupus Ferri Bromidi. U. S. 1880. *Syrup of Bromide of Iron.*

A syrupy liquid containing 10 per cent. of Ferrous Bromide [$FeBr_2$; 215.5].

Iron, in the form of fine wire, and cut into small pieces, 30 parts, or	1¼ oz. av.
Bromine, 75 parts, or	9 fl. dr.
Sugar, in coarse powder, 600 parts, or	28 oz. av.
Distilled Water, a sufficient quantity,	
To make 1000 parts, or about	2 pints.

Introduce the iron into a flask of thin glass of suitable capacity, add to it 200 parts [or 9 fl. oz.] of Distilled Water and afterward the Bromine Shake the mixture occasionally, until the reaction ceases and the solution has acquired a green color and has lost the odor of Bromine. Place the Sugar in a porcelain capsule, and filter the solution of bromide of iron into the Sugar. Rinse the flask and Iron wire with 90 parts [or 4 fl. oz.] of Distilled Water, and pass the washings through the filter into the Sugar. Stir the mixture with a porcelain or wooden spatula, heat it to the boiling point on a sand-bath, and, having strained the Syrup through linen into a tared bottle, add enough Distilled Water to make the product weigh 1000 parts [or measure 2 pints]. Lastly, shake the bottle and transfer its contents to small vials, which should be completely filled, securely corked, and kept in a place accessible to daylight.

Syrupus Limonis. U. S. 1880. *Syrup of Lemon.*

Lemon Juice, recently expressed and strained, 40 parts, or	17 fl. oz.
Fresh Lemon Peel, 2 parts, or	1 oz. av.
Sugar, in coarse powder, 60 parts, or	28 oz. av.
Water, a sufficient quantity,	
To make 100 parts, or about	2 pints.

Heat the Lemon Juice to the boiling point; then add the Lemon Peel, and let the whole stand, closely covered, until cold. Filter, add enough Water through the filter to make the filtrate weigh 40 parts [or measure 17 fl. oz.], dissolve the Sugar in the filtered liquid by agitation, without heat, and strain.

Tinctura Conii. U. S. 1880. *Tincture of Conium.*

Conium in No. 30 powder, 150 parts, or	4¾ oz. av.
Diluted Hydrochloric Acid, 4 parts, or	1 fl. dr.
Diluted Alcohol, a sufficient quantity,	
To make 1000 parts, or	2 pints.

Moisten the powder with 45 parts [or 2 fl. oz.] of Diluted Alcohol, previously mixed with the Diluted Hydrochloric Acid, and macerate for 24 hours; then pack it moderately in a conical glass percolator, and gradually pour Diluted Alcohol upon it, until 1000 parts [or 2 pints] of Tincture are obtained.

Tinctura Ferri Acetatis. U. S. 1880. *Tincture of Acetate of Iron.* [Tincture of Ferric Acetate.]

Solution of Acetate of Iron, 50 parts, or	4 fl. oz.
Alcohol, 30 parts, or	8 fl. oz. 8 fl. dr.
Acetic Ether, 20 parts, or	2 fl. oz.
To make 100 parts, or	9 fl. oz.

Mix the Alcohol and Acetic Ether, and gradually add the Solution of Acetate of Iron, taking care that the mixture remains cool. Keep the Tincture in glass-stoppered bottles, in a cool and dark place.

Tinctura Ignatiæ. U. S. 1880. *Tincture of Ignatia.*

Ignatia, in No. 60 powder, 10 parts, or	8 oz. av.
Alcohol,	
Water, each, a sufficient quantity.	

Mix Alcohol and Water in the proportion of 8 parts [or 4½ pints] of Alcohol to 1 part [or ½ pint] of Water. Moisten the powder with 10 parts [or ½ pint] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the Ignatia is exhausted. Reserve the first 90 parts [or 4½ pints] of the percolate, evaporate the remainder to 10 parts [or ½ pint], and mix with the reserved portion. Of this Tincture take any convenient number of parts, and, by means of a water-bath, evaporate it to dryness. Weigh the resulting extract, and from its weight calculate the quantity of extract contained in the 100 parts of Tincture obtained; then dissolve the dried extract in the remainder of the Tincture, and add enough of the above menstruum to make the product weigh so many parts that each 100 parts of Tincture shall contain 1 part of dry extract. Lastly, mix thoroughly, and filter through paper.

Trochisci Magnesiæ. U. S. 1880. *Troches of Magnesia.*

	Grains.	Grammes.
Magnesia, 300 grains,	300	19.50
Nutmeg, in fine powder, fifteen grains,	15	1.00
Sugar, in fine powder, nine hundred grains,	900	58.50
Mucilage of Tragacanth, a sufficient quantity,		
To make 100 troches,	100	

Rub the Magnesia and the powders together until they are thoroughly mixed; then, with Mucilage of Tragacanth, form a mass, to be divided into 100 troches.

Trochisci Sodii Santoninatis. U. S. 1880. *Troches of Santoninate of Sodium.*

	Grains.	Grammes.
Santoninate of Sodium, in fine powder, 100 grains,	100	6.50
Sugar, in fine powder, 2000 grains,	2000	130.00
Tragacanth, in fine powder, 50 grains,	50	3.25
Orange Flower Water, a sufficient quantity,		
To make 100 troches,	100	

Rub the powders together until they are thoroughly mixed; then, with Orange Flower Water, form a mass, to be divided into 100 troches.

Unguentum Acidi Gallici. U. S. 1880. *Ointment of Gallic Acid.*

Gallic Acid, 10 parts, or	48 grains.
Benzoinated Lard, 90 parts, or	1 oz. av.
To make 100 parts, or about	1 oz. av.

Rub the Gallic Acid with the Benzoinated Lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula.

Unguentum Mezerei. U. S. 1880. *Mezereum Ointment.*

Fluid Extract of Mezereum, 25 parts, or	2 fl. dr.
Lard, 80 parts, or	360 grains.
Yellow Wax, 12 parts, or	54 grains.
To make about	1 oz. av.

Melt together the Lard and Wax with a moderate heat, add the Fluid Extract, and stir the mixture constantly until the alcohol has evaporated; then continue to stir until cool.

Unguentum Sulphuris Alkalinum. U. S. 1880. *Alkaline Sulphur Ointment.*

Washed Sulphur, 20 parts, or	96 grains.
Carbonate of P tassium, 10 parts, or	48 grains.
Water, 5 parts, or	½ fl. dr.
Benzoinated Lard, 65 parts, or	312 grains.
To make 100 parts, or about	1 oz.

Rub the Sulphur with the Carbonate of Potassium and the Water, gradually add the Benzoinated Lard, and mix thoroughly.

Vinum Aloes. U. S. 1880. *Wine of Aloes.*

Purified Aloes, 6 parts, or	2 oz. av.
Cardamom, 1 part, or	146 grains.
Ginger, 1 part, or	146 grains.
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	2 pints.

Mix the Aloes, Cardamom, and Ginger, and reduce them to a moderately coarse (No. 40) powder. Macerate the powder with 90 parts [or 26 fl. oz.] of Stronger White Wine for 7 days, with occasional agitation, and filter through paper; adding, through the filter, enough Stronger White Wine to make the filtered liquid weigh 100 parts [or measure 2 pints].

Vinum Aromaticum. U. S. 1880. *Aromatic Wine.*

Lavender, 1 part, or	72 grains.
Origanum, 1 part, or	72 grains.
Peppermint, 1 part, or	72 grains.
Rosemary, 1 part, or	72 grains.
Sage, 1 part, or	72 grains.
Wormwood, 1 part, or	72 grains.
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	1 pint.

Mix the solid ingredients, and reduce them to a coarse (No. 20) powder. Moisten the powder with 4 parts [or 6 fl. dr.] of Stronger White Wine, pack it moderately in a conical glass percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh 100 parts [or measure 1 pint].

Vinum Rhei. U. S. 1880. *Wine of Rhubarb.*

Rhubarb, in No. 80 powder, 10 parts, or	3¼ oz. av.
Calamus, in No. 80 powder, 1 part, or	140 grains.
Stronger White Wine, a sufficient quantity,	
To make 100 parts, or	2 pints.

Moisten the mixed powders with 5 parts [or 1½ fl. oz.] of Stronger White Wine, pack the mixture in a conical glass percolator, and gradually pour enough Stronger White Wine upon it to make the filtered liquid weigh 100 parts [or measure 2 pints].

APPENDIX.

ANSWERS TO PRACTICAL PROBLEMS AND EXERCISES.

(See page 94.)

[The answers to these questions have been worked out from the data given in the problems or chapters, but may vary slightly from other results on account of the use of metric or other equivalents not given in this book, or because in the answer or in some of the results leading to it, the decimals have not been carried out far enough or perhaps too far.]

1. *Ans.* 700 gr. each of powdered ipecac and opium and 5600 gr. of powdered sugar of milk. **2.** Ten per cent. each of powdered ipecac and opium and eighty per cent. of powdered sugar of milk. **3.** 3195 gr. **4.** 3775 gr. **5.** 34 cents. **6.** 128. **7.** 7680. **8.** 9600. **9.** 1750. **10.** 1822.8. **11.** 1920. **12.** 48 + (1 pint = 7291.2 gr.). **13.** 41.66 +. **14.** 30. **15.** Linseed oil, f℥ij; lime water, f℥iv. **16.** Six. **17.** Place 4.55 gr. (one per cent. of 455 gr.) of cocaine hydrochlorate in a graduate, and dissolve it in enough distilled water to make a fluidounce; or, more conveniently, dissolve 5 grains in 1 fl. oz. 40 min. of water and use 1 fl. oz. of the solution. **18.** Strychnine, 2 gr.; quinine, 128 gr.; ferric phosphate, 256 gr. **19.** $1.20. **20.** He would lose $1. **21.** 7500 mm. **22.** 3.0623 M. **23.** 6.30 M. **24.** 12.543 M. **25.** 12.543 M. **26.** 1.001 M. **27.** Twenty-five dekametres. **28.** Twenty-five decimetres. **29.** Yes. **30.** One metre and twenty centimetres. **31.** $1.2 is an unusual way of expressing one dollar and two-tenths: one dollar and two dimes is also unusual; but one dollar and twenty cents is common. **32.** Four thousand two hundred and sixty-three metres and six hundred and seventy-eight millimetres. **33.** 81.396 M. (Place each row in position, beginning at the right-hand column, and add in the usual manner; if 816 cm. is to be placed, beginning with 6 in the centimetre place, and 8 would be in the metre place, thus 8.16; 732 dm. would be 73.2, while 36 mm. would be 0.036)—

$$\begin{array}{r} 8.16 \\ 73.2 \\ 0.036 \\ \hline 81.396 \end{array}$$

34. 0.015 M. **35.** 478.016 M. **36.** 500. **37.** 3.36 sq. M. **38.** 3.3608 sq. M. **39.** 3.030303 sq. M. **40.** 20.202020 sq. M. **41.** 505.0005 sq. M. **42.** 1,000,000. **43.** 63.063063063 cu. M. **44.** 1000. **45.** A litre. **46.** 50. **47.** 174.625 L., or 174 L. 625 C.c. **48.** Oil of juniper, 2 Gm.; oil of caraway, oil of fennel, each 0.20 Gm.; alcohol, 600 Gm.; water, 397.60 Gm. **49.** Oil of juniper, 14 gr.; oil of caraway, oil of fennel, each 1.4 gr.; alcohol, 4200 gr.; water, 2783.2 gr. **50.** 82.28 +. **51.** 62.49 + fl. oz. (7291.2 × 1.405, the sp. gr. of solution of chloride of iron (see page 88), = 10244.136, the weight of one pint of solution of chloride of iron; 10244.136 × 37.8 = 3872.2834080, the number of grains of anhydrous salt in one pint of solution of chloride of iron; 10 times this amount (10 × 3872.2834080) equals the weight in grains of a solution containing 10 per cent. of anhydrous salt, 38722.834 gr.; now if the weight of one pint of solution of chloride of iron be subtracted from it, the remainder must be the number of grains of water to be added to make the whole 10 per cent., 38722.834 — 10244.136 = 28478.698; then 28478.698 ÷ 455.7 (the number of grains in a fluidounce of water) = 62.49 + fl. oz.). **52.** 8.46 + fl. oz. solution, 7.53 + fl. oz. water. **53.** 15 per cent. **54.** 5.5 gr. **55.** 377 gr. **56.** 16 min. **57.** 480. **58.** 630 gr. **59.** 604.88 + gr. **60.** 497.6 + gr. **61.** [illegible] **62.** 3235.47 gr. **63.** 25.277 + gr. **64.** 23.709 + gr. **65.** 3059 gr. **66.** 4938.69 + gr. **67.** 38.58 + gr. **68.** 15.5 + min. **69.** 2762.19 +. **70.** 103.78 + min. **71.** 1800. **72.** 61.025 + (gallon = 231 cu. in.). **73.** .4731 +. **74.** 28814.87 +. **75.** 946.32 +. **76.** 2113.4 +. **77.** 270.52 +. **78.** 453.59 +. **79.** 1370.17 +. **80.** 378250.38 +. **81.** 91.44 +. **82.** 189. **83.** 1021.2. **83*a*.** 1.0212. **83*b*.** 1021200. **84.** 1609.329 +. **85.** 721.65 +. **86.** 187.2. **87.** 5 oz., 262.5 gr. **88.** 20. **89.** 3.47 + gr. **90.** .324 Gm., 5 gr. nearly. **91.** 5248 gr. **92.** 10 lbs. troy, or 8 lbs. 3 oz. 287.5 gr. av. **93.** 30 lbs. troy, or 24 lbs. 10 oz. 425 gr. av. **94.** 8 lbs. 9 oz. 332.5 gr. troy, or 7 lbs. 3 oz. 37.5 gr. av. **95.** 3.982.

96. 4.2. **97.** 11.45. **98.** 6.49. **99.** 1 ÷ 6.49 = .154 +. **100.** 4.680 Kilogrammes. **101.** 625 centimetres. **102.** 21.84 Kilogrammes. **103.** 11.5. **104.** 4.2. **105.** 0.960 +. **106.** 1.492 + chloroform. **107.** 1.25 glycerin. **108.** 591.88 +. **109.** 86.96 +. **110.** 704.98 +. **111.** 44.05 + Gm. **112.** 0.4781 +. **113.** $\frac{1}{1034}$. **114.** $\frac{1}{1920}$. **115.** $\frac{1}{15}$ (Oj = 478.11 C.c.). **116.** 0.845.

$$\begin{array}{r} 68.25 \\ 85.7 \\ \hline 82.55 \end{array} \qquad \begin{array}{r} 177.45 \\ 82.55 \\ \hline 210.00 \end{array} \qquad \begin{array}{r} 210\,)\,177.45\,(\,.845 \\ 1680 \\ \hline 945 \\ 840 \\ \hline 1050 \\ 1050 \end{array}$$

117. 400 gr. **118.** 16 oz. av. Weight of bottle 15 oz. av. **119.** 454.21 + (Oj = 478.11 C.c.). **120.** 56 lbs. 4 oz. 164.04 gr. av. **121.** 726.74 + (Oj = 478.11 C.c.). **122.** 11.45 +. **123.** 7.69 +. **124.** 9. **125.** 10.6 +. **126.** 5 pints carbolic acid cost $2.21 +, 5 pints glycerin cost $2.08 +; the druggist therefore loses 13 + cents. **127.** 1.31. 1560 : 7.8 : : 262 : 1.31. **128.** .820 alcohol. **129.** 11220 lbs. 399.360 gr. av. (1 cu. in. 252.509 gr.) = 180 cubic feet; volume = 192 cubic feet. **130.** 11 gallons 8 pints 12.37 fl. oz., or 95 lbs. 7 oz. 76.814 gr. av. **131.** .0788 +. **132.** .9345 +. **133.** .8. **134.** .5. **135.** 15.67 fl. oz. **136.** 9.8 C.c. **137.** 36.456 gr. (see answer to No. 17). **138.** 25.56 oz. av. **139.** Weight of the bottle, 7436.94 gr.; weight of the syrup, 8598.06 gr.; weight of the oil, 5907.06 gr. **140.** Weight of the bottle, 6125 gr.; weight of the water, 7000 gr. **141.** Weight of the water, 16.5 oz. av.; weight of acid, 19.14 oz. av.; sp. gr. 1.16; hydrochloric acid.

ALLIGATION.

1. 2 parts of 7 p. c. and 9 parts of 18 p. c. **2.** 4 parts of 7 p. c. and 7 parts of 18 p. c. **3.** 6 parts of 7 p. c., 7 parts of 16 p. c., and 7 parts of 18 p. c. **4.** 4 parts of 7 p. c., 2 parts of 8 p. c., 6 parts of 16 p. c., 7 parts of 18 p. c., or 2 parts of 7 p. c., 4 parts of 8 p. c., 7 parts of 16 p. c., 6 parts of 18 p. c. **5.** 7 parts of 9 p. c., 5 parts each of 15, 16, and 18 p. c. **6.** 2 parts of 7 p. c., 2 parts of 8 p. c., 2 parts of 9 p. c., 2 parts of 11 p. c., and 21 parts of 16 p. c.

14.

7	8	9	11	16
2	2	2	2	7
				6
				5
				3
2	2	2	2	21

7.

$$\begin{array}{rr} 7 \text{ parts of } 77 \text{ p. c.} & 539 \\ 7 \text{ parts of } 83 \text{ p. c.} & 581 \\ 10 \text{ parts of } 92 \text{ p. c.} & 920 \\ \hline 24 & 24)\overline{2040} \\ & 85 \end{array}$$

85.

77	83	92
7	7	2
		8
7	7	10

8. 10 oz. **9.** 18 parts of glycerin and 25 parts of alcohol. **10.** 36 parts of glycerin and 125 parts of diluted alcohol. **11.** 58.82 ounces of 94 p. c. and 41.18 ounces of 60 p. c. **12.** 148.7 C.c. of alcohol, 77.8 C.c. of glycerin, and 24 C.c. of syrup. **13.** 26 pints of 0.820, 8 pints each of sp. gr. 0.985 and sp. gr. 0.865. **14.** 5 troy ounces.

14.

8	17
8	6

6 : 8 : : 10 : 5

$$\begin{array}{r} 10 \times 17 = 170 \\ 5 \times 8 = 40 \\ \hline 15 \qquad\quad 210 \end{array}$$

210 ÷ 15 = 14 p. c.

15. 160 gr.

13.

12	16
3	1

3 : 480 : : 1 : 160

16. $685\frac{5}{7}$ gr.

85.

75	92
7	10

7 : 480 : : 10 : $685\frac{5}{7}$

17. 70.2054 fl. oz. (7291.2 × 2 × .820 = 11957.568 grains in a quart of U. S. P. alcohol; and 11957.568 × .91 = 10881.38688 grains of absolute alcohol (91 p. c. absolute alcohol in U. S. P. alcohol).

35.

91	0
35	56

35 parts of alcohol (91 p. c.) require 56 parts of water to make the mixture 35 p. c., or 5 parts require 8 parts; then as 5 : 8 : : 11957.568 : 19132.1088, and 19132.1088 + 11957.568 gr. ÷ 437.5 = 71.06 + oz. av.

18. 12.4 oz.

14.

$10\frac{5}{9}$	$16\frac{1}{2}$
$2\frac{1}{2}$	$3\frac{4}{9}$

$2\frac{1}{2}$: 9 : : $3\frac{4}{9}$: 12.4

4 oz. 10 p. c. = 40
5 oz. 11 p. c. = 55
9   95

95 ÷ 9 = $10\frac{5}{9}$ p. c.

19. 24 oz.

14.

10.4	15.5
1.5	3.6

1.5 : 10 : : 3.6 : 24

3 oz. 9 p. c. = 27
$3\frac{1}{2}$ oz. 10 p. c. = 35
$3\frac{1}{2}$ oz. 12 p. c. = 42
10   104

104 ÷ 10 = 10.4 p. c.

20. 640 gr. 8 p. c., 1280 gr. 11 p. c., 1920 gr. 16 p. c. and 960 gr. 18 p. c. **21.** 31 parts to every $14\frac{1}{2}$ parts. **22.** 7 oz. 211.69 + gr. 31 : 14.5 : : 7000 gr. : 3274.19 gr.

23. 6 ℥ 192 gr.

14.

16	$18\frac{1}{2}$
$\frac{1}{2}$	2

For one part of 16 p. c. he must use 4 parts of $18\frac{1}{2}$ p. c., or $\frac{4}{5}$ of the whole amount of $18\frac{1}{2}$ p. c. $\frac{4}{5}$ of 8 oz. = 6 oz. 192 gr.

24.

2.

1.6	$3\frac{7}{8}$
$1\frac{7}{8}$	.4

$1\frac{7}{8}$ oz. = 900 gr.
$\frac{4}{10}$ oz. = 192 gr.
or in the proportion of 75 to 16.

25. 20 parts of $\frac{15}{16}$ths of 1 p. c. and 17 parts of $3\frac{1}{4}$ p. c. **26.** 23 parts of 1.235 p. c. and 51 parts of 2.345 p. c. **27.** 11 parts of 1.676 p. c. and 8 parts of 3.188 p. c. **28.** 43 parts of 0.840 p. c., 43 parts of 1.848 p. c., and 82 parts of 2.688 p. c. **29.** 9 oz. $256\frac{3}{4}$ gr. If 43 parts are equal to 5 oz., then by proportion 82 parts are equal to 9 oz. $256\frac{3}{4}$ gr. **30.** 5 oz. of 0.840 p. c., 11.7905 oz. of 2.688 p. c., and 15.2095 oz. of 1.848 p. c. **31.** 32 oz. of solution, 2.64 oz. of water. **32.** 6 fl. oz. 4 fl. dr. 48 min. 32 : 2.64 : : 80 : 6.6. **33.** 14.4 fl. oz. of sp. gr. 1.312, 9.6 fl. oz. of sp. gr. 1.332. **34.** 57.6 fl. oz. water. **35.** $11\frac{3}{7}$ oz. 28 : 10 : : 32 : $11\frac{3}{7}$. If in 28 oz. there are 10 oz. of the stronger water of ammonia, then 32 oz. will require $11\frac{3}{7}$ oz. **36.** 12.3 + fl. oz.

81.

94	76
5	13

13 : 5 : : 32 : 12.3

37. 91 fl. oz. 6.9 fl. dr.

GLOSSARY

OF

UNCOMMON NAMES, TERMS, OR SUBSTANCES.

A.

Acetum Acerrimum. Concentrated acetic acid.
Bezoardicum. Aromatic vinegar.
Saturni. Solution of lead subacetate.
Theriacale. Aromatic vinegar.
Acetylphenylamine. Acetanilid, *U. S. P.*
Acid, Anticyclic. Mixture of antipyrin and salicylic acid.
Boroboracic (Acid Boroboric). Mixture of equal parts of borax and boric acid.
Borussic. Prussic. Hydrocyanic.
Carbazotic (Picronitric acid). Picric acid.
Coalic. Obtained by treating coal with 34 per cent. nitric acid.
Cresylic. Cresol.
Nancic. Lactic acid.
Phenic. Carbolic acid.
Sozoiodolic. Diiodoparaphenolsulphonic acid. (Antiseptic.)
Sozolic. Orthophenolsulphonic acid.
Sulphhydric. Hydrogen sulphide. Sulphuretted hydrogen. Hydrosulphuric acid.
Thiolinic. Sulphurated and sulphonated linseed oil.
Tumenolsulphonic. Obtained by treating the distillate of a mineral oil with sulphuric acid.
Acidum Asepticum (Acidum Aseptinicum). Mixture of solution of hydrogen peroxide with boric and salicylic acids.
Chloronitrosum. Nitrohydrochloric acid.
Cœruleum (Blue acid). Hydrocyanic acid.
Muriaticum Oxygenatum. Chlorine.
Nitrico-Nitrosum. Fuming nitric acid.
Ossium. Glacial phosphoric acid.
Scytodepsicum. Tannic acid.
Actina. Contains menthol, oil of mustard, and ether.

Adeps Anserinus. Goose-grease.
Gadi. Cod-liver oil.
Lanæ. Lanolin (purified wool-fat).
Ovillus. Mutton-suet.
Adipatum. Substitute for lard; a mixture of lanolin, vaselin, and ceresin.
Adragante. Tragacanth.
Aer Fixus. Carbonic acid gas.
Aerosus Lapis. Lapis calaminaris.
Aerozol. Ozonized volatile oils. (Ozone Co., New York.)
Ærugo. Crude copper acetate.
Æs. Copper.
Æs Aratum. Copperas.
Æther Vegetabilis. Acetic ether.
Ætheroleum. Volatile (essential) oil.
Æthiops Antimonialis. Chiefly a mixture of black antimony and mercury.
Martialis. A black iron oxide; formed by keeping iron filings covered with water for a long time.
Mineralis. Mixture of mercury and sulphur.
per se. Mercury oxide.
Vegetabilis. Charcoal of sea-weed.
Affium. Extract of poppy-heads (opium).
Agathin. Salicylalphamethylphenylhydrazone. (Anodyne.)
Agnine. Lanolin without the water. (Metcalf & Co., Boston.)
Agopyrin. Said to be a mixture of salipyrin, ammonium chloride, and cinchonine sulphate. (Influenza remedy.)
Alabastine. An improved kalsomine.
Alanin-Mercury. Mercury amidopropionate.
Alboline. A purified petroleum product, similar to white vaselin. (McKesson & Robbins.)
Album Græcum. Excrement of dogs.
Nigrum. Excrement of mice or rats.
Alcohol Sulphuris. Carbon disulphide.
Alcolene. A mixture of ethyl and methyl alcohols.
Alcoolat (French). A distilled spirit.
Alcoolature (French). An alcoholic tincture of a fresh plant. ("Green tinctures.")

Alcoolé (French). An alcoholic solution of a substance entirely soluble in the alcohol.
Alegar. Ale vinegar. (Made by fermenting ale upon raisins or vine cuttings.)
Alexine. A generic name for protective albuminous preparations used for inoculations.
Algaroth. Antimony oxychloride.
Alkali, Vegetable. Potassium carbonate.
  Volatile. Ammonium carbonate.
Alkalithia. Contains caffeine, sodium, and potassium bicarbonates, and lithium carbonate. (Specialty of Keasbey & Mattison.)
Alkathrepta. A homœopathic preparation of cacao.
Almond Bran. A cosmetic powder for washing, consisting of perfumed powdered almonds and borax.
Alum, Rock (Alumen Rupeum). Lump alum as it occurs with the earth attached.
  Roman. See Rock Alum.
Alumen Plumosum. Asbestos.
Alumnol. Aluminum salt of oxymethylsulphonic acid. Aluminum naphtol sulfonate. (Astringent antiseptic.)
Amadou. Punk; tinder.
Ambretta Seeds. Musk seeds.
Amianthus. Asbestos.
Amidol. Diamidophenol (for photographic purposes).
Amidum. Starch.
Ammonium Carbonicum Pyro-Oleosum. A mixture of ammonium carbonate with "animal oil."
  Sulpho-Ichthyolate. Ichthyol.
Amphion. Opium.
Amplosia. An unfermented juice of the grape.
Amylopsin. Starch-converting ferment of the pancreatic juice.
Analgene. An antineuralgic and anodyne. Orthoexethylalphamonoacetylamidochinoline. Orthoöxyethylanamonobenzoylamidoquinoline.
Analgesine. Antipyrin.
Anaphromeli. Clarified honey (Mel despumatum).
Anaspalin. Ointment base, similar to lanolin.
Angioneurosin. Nitroglycerin.
Anima Articulorum (Life of the Limbs). A name given to colchicum.
  Rhei. Aqueous tincture of rhubarb.
Annidalin. Aristol. (Antiseptic.)
Anodynin. Antipyrin.
Antacidines. Lime-water tablets. (Metcalf & Co., Boston.)
Anthos (Flores or Herba). Rosemary (flowers or herb).
Anthrakokali. Coal treated with caustic potassa.
Anthrarobine. Dioxyanthranol. Leucoalizarin. (Antiseptic dermic.)
Antibacteride. A mixture of borax, boric acid, and glucose.
Anticholerine. A product of cholera bacteria, according to Klebs.
Antidiphtherine. Potassium chlorate with a trace of iron chloride.
Antidotum Fuchsi. Fluid ferric hydrate. (Arsenic antidote.)
Antifebrin. Acetanilid, *U. S. P.* Acetylphenylamine. Phenylacetamide.
Antifungin. Antiseptic. Contains magnesium biborate and free boric acid.
Antikamnia. An anodyne. Said to be a mixture of antifebrin, sodium bicarbonate (with or without caffeine), and tartaric acid. (Anodyne, antipyretic.)
Antikol. Mixture of acetanilid, sodium bicarbonate, and tartaric acid.
Antimonium Album. Bismuth.
Antimony, Diaphoretic. Potassium antimonate.
Antinervine. Salicyl-bromanilid. Said to be a mixture of acetanilid, ammonium bromide, and salicylic acid. (Sedative.)
Antinonnine. Potassium orthodinitrocresol with soap and glycerin. (Parasiticide.)
Antipyrin. Analgesine. Anodynine. Dimethyloxychinozin. Parodyn. Metosin. Phenazon. Phenylon. Phenyldimethylpyrazolon. Pyracin. Phenyldimethylisopyrazolon. Pyrazolon. Oxydimethyl-chinizin. Sedatin. Oxydiëthylquinizine.
Antisepsin. Monobromacetanilid. Paramonobromphenylacetamide.
Antiseptin. Mixture of zinc iodide and sulphate with boric acid and thymol.
Antiseptol. Cinchonine iodosulphate. (Antiseptic.)
Antithermal. A new antipyretic of unknown composition.
Antithermin. Phenylhydrazine-lævulinic acid. (Antipyretic.)
Antlia Gastrica. Stomach-pump.
Apioline. Chapoteau's specialty; active principle of parsley.
Apone. Liniment. (Capsicum, ammonia, chloral.)
Apyonin. French designation for yellow pyoktanin. (Antiseptic.)
Apyrothium. Sulphur.
Aqua Binelli. Creosote water.
  Bullientis (Aquæ). Boiling water.
  Cerasorum. Diluted bitter almond water.
  Crotonis. Water from Croton Lake, New York (that is, hydrant water).
  Flava. Yellow wash.
  Fœtida Antihysterica. A distillate from asafetida, galbanum, myrrh, valerian, etc.
  Fortis. Nitric acid.

Aqua Gummosa. Diluted mucilage of gum arabic (about 1 part of gum in 64 of water).
Hydrothionica. Sulphuretted hydrogen water.
Laxativa Viennensis. Compound infusion of senna. (Modified black draught.)
Metallorum. Mercury.
Naphæ. Orange flower water.
Nigra. Black wash.
Phagedænica. Yellow wash.
Regis. Nitrohydrochloric acid.
Saturnina. Lead water.
Vitæ. Brandy or whiskey.
Aquila Alba. Calomel.
Aquozon. Ozonized water. (Ozone Co., New York.)
Argentum Fugitivum. Quicksilver.
Musivum. Mosaic gold.
Vivum. Quicksilver.
Argilla. Clay. (In pharmacy it means alumina.)
Sulphurica Alcalisata. Alum.
Argols. Crude potassium bitartrate.
Aristol. Dithymoldiiodide. Di-iodo-dithymol. (Antiseptic.)
Arquebusade. An agreeably smelling vulnerary water, which might be called "compound sage water."
Asa Dulcis. Benzoin.
Asaprol. Calcium salt of betanaphtol-alphamonosulphonic acid. (Antiseptic.)
Asbolin. An alcoholic distillate of soot. (Antitubercular.)
Asepsin. Antisepsin.
Aseptin. Mixture of boric acid, borax, and alum.
Aseptol. Sozolic acid. Orthophenyl-sulphonic acid (33 per cent. aqueous solution).
Asparoline. Contains guaiacum, asparagin, parsley seed, black haw, and hyoscyamus. (According to Wampole & Co., Philadelphia.)
Ater (Atra). Black (Niger).
Atramentum. Black ink.
Indicum (Sinense). India ink.
Auramin. Yellow pyoktanin. (Antiseptic.)
Aureoline. Hair bleach. (A more or less diluted solution of hydrogen peroxide.)
Aurum Musivum (Mosaic Gold). Tin bisulphide.
Axungia. Adeps. (Fat.)

B.

Baker's Salt. Ammonium subcarbonate.
Balata. Gum chicle.
Balsam, Friar's. Compound tincture of benzoin.
Balsam, Hungarian. Exudation from Pinus pumilio.
Persian. Compound tincture of benzoin.
Riga. By distillation from the leaves of Pinus cembra; generally an artificial aromatic spirit.
Sulphur. Sulphurated linseed oil.
Traumatic. Compound tincture of benzoin.
Balsamum Arcæi. An ointment of elemi.
Gileadense. Balm of Gilead.
Judaicum. Balm of Gilead.
Nucistæ. An ointment containing the volatile and fixed oils of nutmeg.
Ophthalmicum Rubrum. Ointment of red precipitate.
Saponaceum. Opodeldoc.
St. Yves. Ointment of red precipitate.
Universale. Ointment of lead subacetate, made with yellow wax and rape-seed oil.
Verum. Balm of Gilead.
Vitæ Hoffmanni. Alcoholic solution of sundry balsamic oils.
Bang. Cannabis Indica.
Barbotine. See Semen Contra.
Barilla. Impure sodium carbonate.
Barm. Yeast.
Baudruche. Goldbeaters' skin.
Baume de Vie. Compound decoction of aloes.
Tranquille. Compound infused oil of hyoscyamus.
Belle Dame. Atropa belladonna.
Benedictum Vinum. Antimonial wine.
Benzene. Of English chemists, means benzol (coal-tar benzin), and not the American benzin (from petroleum).
Benzoic Ether. Ethyl benzoate.
Benzonaphtol. Betanaphthylbenzoate. Betanaphtol-benzoate. (Intestinal antiseptic.)
Benzophenoneid. Apyonin (yellow pyoktanin).
Benzosol. Benzoyl-guaiacol. Guaiacol benzoate (Antitubercular.)
Betel Nut. Areca nut.
Betol. Betanaphthyl salicylate. Betanaphtol salicylate. (Intestinal antiseptic.)
Big "G." Injection. Contains borax and berberine.
Bilis Bovinum. Ox's gall.
Bi-Palatinoid. Gelatin capsule divided by a partition, to keep two powders separate until swallowed.
Bitumen Judaicum. Asphaltum.
Black Draught. A compound infusion of senna; must not be confounded with "Black Drop."
Black Drop. Vinegar of opium.

Black Flux. A mixture of charcoal and potassium carbonate.
Blanc Fixe. Artificial barium carbonate or sulphate.
Blue, Berlin. Prussian blue.
Black. A name for ivory-black.
Chinese. Prussian blue.
Bolus Armena. Red bole. Bole Armenian.
Boroglyceride. Boroglycerin.
Boroglycerin. A concentrated solution of boric acid in glycerin.
Borol. Fused mixture of boric acid and sodium bisulphate.
Borussic. Prussian. Hydrocyanic.
Bovinine. Meat juice preserved by glycerin and boric acid.
Bovox. An essence of beef. (Boston.)
Bovril. Extract of beef, peptone, albumen, and fibrin. (London.)
Brain Salt, Effervescent. Contains chiefly ammonium bromide and caffeine.
Brasium. Malt.
British Gum. Dextrin.
Brofeine. Specialty of Wohlfarth, New York (?).
Bromo-Febrin. Said to be potassium or ammonium bromide and antifebrin. (Specialty of Weiller & Co., Baltimore.)
Bromo-Caffeine. Specialty of Keasbey & Mattison, Ambler, Pa.
Bromo-Pyrene. Specialty of Wampole, Philadelphia.
Bromo-Soda. Specialty of Warner & Co., Philadelphia.
Bromol. Tribromophenol. (Antiseptic.)
Brotipyrine. Specialty of Stearns & Co., Detroit.
Butter of Antimony. Solution of antimony chloride.
Butylhypnal. Butylchloral-antipyrin.
Butyrum Majoranæ. Ointment of sweet marjoram.
Nucistæ. Expressed oil of nutmeg.
Byne (Bynin). Apparently a favorite name in England for malt and malted preparations.
Bynol. Malt and cod-liver oil. (Allen & Hanbury, London.)

C.

C. See also K.
Cactina. A preparation of Cactus grandiflorus. (Sultan Co., St. Louis.)
Caffa. Camphor.
Caffeoresorcin. Combination of caffeine with resorcin.
Cail-Cedra. Bark of Swietenia senegalensis.
Calamine. Impure zinc carbonate.
Calcithos. Copper subacetate.
Calisaya. Cinchona (Yellow).
Camphoid. Gun-cotton dissolved in an alcoholic solution of camphor. 1 : 20 solution of pyroxylin in Rubini's camphor solution. (Vehicle for dermics.)
Camphol. A mixture of camphor and salol. (Antiseptic.)
Camphor Julep. Camphor mixture.
Camphorline. A trade name for naphtalin.
Cancroin. Extract of cancerous tumors, according to Adamkiewicz. (Alexine of cancer, according to Adamkiewicz.)
Cancrorum Lapilli. Crabs' stones.
Chelæ. Crabs' claws.
Candelæ Fumales. Fumigating pastilles.
Canthos. A special cantharidal plaster of Johnson & Johnson, London.
Capita Papaveris. Poppy-heads.
Capsulæ Amylaceæ. Wafer capsules.
Carbasus. Gauze.
Carboline. A hair preparation. Perfumed liquid vaselin.
Carbon Black. The soot of natural gas.
Carnine Syrup, Niemann's. Beef juice preserved by cane sugar.
Cassius's Purple. A compound of tin with gold oxide.
Castoria. A laxative. Said to be a modified compound infusion of senna.
Celerina. Said to be a combination of celery, black haw, coca, and probably kola.
Cera Sigillata. Sealing-wax.
Cerate, Compound Camphor. Camphor ice.
Ceratum Citrini (P. L. 1745). Resin cerate.
Epuloticum (P. L. 1745). Ceratum calaminaris. Turner's cerate.
Labiale. Lip salve.
Lithargyri Acetati Compositum. Goulard's cerate. (P. L. 1787.)
Cerate, Turner's. Cerate of calamine.
Ceresin. Earth-wax. An impure paraffin.
Cerussa. Lead carbonate.
Chalcanthum. Copperas.
Charpie. Lint.
Chelen (Kelene). Ethyl chloride. (Local anæsthetic.)
Chemical Food. Compound syrup of phosphates.
Chinium. Quinine.
Chionia. A preparation of Chionanthus. (Peacock Co., St. Louis.)
Chloral Caffeine. Molecular combination (1 : 1) of chloral and caffeine. (Anodyne, antispasmodic.)
Camphor. A mixture of chloral and camphor.

Chloral Carmine. Staining fluid prepared by heating together on a water-bath for half an hour .05 Gm. carmine, 20 C.c. absolute alcohol, and 30 drops hydrochloric acid (sp. gr. 1.124), adding 25 Gm. chloral hydrate, and filtering when cool.
Chloralamide. Chloral formamide.
Chloralimide. Trichlorethylidenimide.
Chlorobrom. Solution of potassium bromide and chloralamide in water.
Chlorol. Solution of corrosive sublimate, sodium chloride, hydrochloric acid, and copper sulphate in water. (Antiseptic.)
Chlorophenol. Antiseptic.
Christia. Manilla paper made waterproof with chrome gelatin.
Chymosin. Pepsin.
Cibus Deorum. Asafetida.
Cineres Clavellati. Crude potassium carbonate.
Cinnabar (Vermilion). Mercuric sulphide.
Coal-Tar Naphtha. Benzol.
Cognac. Brandy.
Colcothar. Crude ferric oxide.
Colla Piscium. Isinglass.
Conchinine (of the German chemists). Quinidine
Confectio Cardiaca. Aromatic confection.
  Damocratis. Damocrates' confection. An aromatic astringent confection containing opium, which originally had 64 ingredients.
Connecticut Lead. Barytes.
Cornu Cervi. Hart's horn. Ammonium carbonate.
  Cervi Ustum Nigrum. Bone-black.
Cream of Tartar, Soluble. Potassium and sodium borotartrate.
Cremor Antisepticus. Chiefly vaselin and thymol. (London.)
Creolin. Mixture of coal-tar hydrocarbons with resin soap (Pearson's), or with cresolsulphonic acid (Artmann's creolin).
Creosotal. Creosote carbonate.
Creosote Carbonate. Chiefly an impure guaiacol carbonate.
Cresalol. Paracresol salicylate. Paracresylic ether of salicylic acid. (Intestinal antiseptic.)
Cresol. Cresylic acid.
Cresolin. A preparation similar to creolin.
Cresylol. Cresol. Cresylic acid. Metacresol. (Antiseptic.)
Crocus Martis. Ferric oxide.
  Metallorum (Antimonii). Brown antimony oxide.
  Saturni. Red lead.
Croton-Chloral. Butyl-chloral.
Cryst Alba. Refined naphtalene. (Disinfectant.)
Crystalli Tartari. Cream of tartar.
Cuca. Coca.
Cullet. Broken glass for remelting.
Cuprum Scoriatum. Crude copper acetate. (Verdigris.)
Curaçao. Elixir of orange peel.
Cutch. Dark (black) gum catechu.
Cynosbatæ. See Hips.

D.

Dactyli. Dates.
Dagutt. See Daggett, Oil of.
Dasjespis. Inspissated urine of the South African badger (Hyrax).
Decoctum Album. A kind of chalk mixture.
  Diaphoreticum. Compound decoction of guaiacum.
  Lignorum. Compound decoction of guaiacum wood.
  Zitmanni. Compound decoction of sarsaparilla.
Dermatol. Bismuth subgallate. (Astringent antiseptic.)
Derosne's Salt. Narcotine.
Diabolus Metallorum. Tin.
Diacodium. Poppy-heads. (Old name for syrup of poppies.)
Diagrydium. Scammony.
Diana. Silver.
Diapente. A tonic powder, or electuary, composed of 5 ingredients.
Diaphtherin. Oxychinaseptol. (Oxychinolin and orthosulphonic acid.) Orthophenol sulphonate. (Antiseptic.)
Diascordium. An aromatic electuary of tormentil root and scordium (water germander) with opium.
Dilapsus. As an adjective to several salts means effloresced.
Dimethyl-oxy-chinizin. Antipyrin.
Disinfectant, Jeye's. Mixture of coal-tar hydrocarbons with resin soap.
  Ledoyen's. Solution of lead nitrate.
Disinfectol. A product similar to creolin.
Dithione. Mixture of the sodium salts of the isomers of dithiosalicylic acid. (Antirheumatic.)
Diuretin ("I. & II."). Theobromine sodium salicylate. (Diuretic.)
Draco Mitigatus. Calomel.
Dulcin. A new sweetening agent. Paraphenetolcarbamid. (Sucrol.)
Dutch Drops. Haarlem oil.
  Liquid. } The chloride of olefiant
  Oil. } gas.
  Tea. A variety of St. Germain tea. (Laurent.)

E.

Earth, Japan. Catechu.
Nut. Peanut.
Eau de Rabel. See Elixir, Haller's.
Sédative de Raspail. Contains ammonia, salt, camphor, alcohol, and water.
Ebur Ustum. Boneblack.
Eikonogen. Sodium salt of the amidobetanaphtolbetamonosulphonic acid. (For photographic purposes.)
Elæosaccharum. Oil sugar. (Sugar flavored with volatile oil.)
Electuarium. Confection. (Soft.)
Dentifricium. Tooth paste.
Elephant Louse. The nut of cashew.
Eliteine. Specialty of Ingram, Detroit, Mich. (Skin lotion.)
Elixir Adjuvans. A kind of simple elixir.
Anisi. Aniseed cordial.
Aperitivum. Compound tincture of aloes.
Aurantiorum Compositum. A compound elixir of orange peel and gentian.
of the Three Chlorides. Contains iron, mercury, and arsenic, with elixir cinchona. (Renz & Henry, St. Louis.)
Corrigens. Aromatic elixir of yerba santa.
Daffy's. Compound tincture of senna.
Garus. Mixture of syrup with an alcoholic distillate of aloes and spices.
Haller's. 3 parts alcohol and 1 part sulphuric acid, mixed slowly.
of Long Life. A modification of the well-known Swedish Bitters.
ad Longam Vitam. Elixir of Long Life.
Nutrans. Tonic. (Allaire, Woodward & Co., Peoria, Illinois.)
Pectorale. Compound ammoniated elixir of liquorice with oils of fennel and anise.
Proprietatis (Paracelsi). Compound tincture of aloes and myrrh.
Purgans. Compound tincture of jalap.
Rhei Darelii. Tinctura rhei dulcis.
Roborans Whyttii. Compound tincture of cinchona (containing saffron).
Salutis. Compound tincture of senna.
Stomachic. } Compound tincture
Stoughton's. } of gentian.
Viscerale. Compound tincture of orange peel and gentian.
Vitrioli Mynsichti. Aromatic sulphuric acid.
Emplastrum Cantharidum Perpetuum. A mild cantharidal plaster.
Fuscum. Mother plaster. Universal plaster. Brown salve.
Gummosum. Compound plaster of galbanum.
Ens Martis. Ammoniated iron.
Veneris. Ancient name of ammonium and copper chlorides.
Epidermine. Ointment basis, consisting of white wax, water, gum, and glycerin, equal parts.
Ergotole. Specialty of Sharp & Dohme, Baltimore.
Eserine. Physostigmine.
Essence (French). Volatile oil.
of Mirbane. Nitrobenzol. (Artificial oil of bitter almonds.)
Éthérolat, Éthérolaturé, Éthérolé (French). Correspond to the alcoholic terms. (See Alcoolat, etc.)
Ethyl Bromide. Monobrom-ethane. Must not be confounded with ethylene bromide.
Ethylene Bromide. Dibrom-ethane. Different from ethyl bromide.
Eucalypteol. Eucalyptene bichloride (according to Lafarge). (Antiseptic.)
Eucalyptoresorcin. Combination of eucalyptol and resorcin.
Eulyptol. A mixture of salicylic acid, carbolic acid, and oil of eucalyptus. (Antiseptic.)
Euphorin. Phenyl-urethane. Phenylethylic urethane. Ethyl and phenyl carbamate.
Europhen. Diisobutylorthocresoliodide. Substitute for iodoform.
Exalgin. Methylacetanilid. Methylphenylacetamide. (Anodyne.)
Exodine. Mixture of acetanilid, sodium salicylate, and sodium bicarbonate. Exodyne. (Antipyretic.)
Expectorant, Stokes's. Senega and squill cough mixture with ammonium carbonate.
Extract of Apple, Ferrated. Crude iron malate.
Extractum Catholicum. Compound extract of rhubarb.
Martis Pomatum. Crude iron malate in the form of extract.
Panchymagogum Crollii. Compound extract of rhubarb. (Rhubarb, aloes, jalap, soap.)
Eyesolene. Eye-salve of Spitler & Drexler, Paterson, N.J.
Eyestones. Crabs' eyes.

F.

Faba Porcina. } The fruit of Hyoscya-
Suilla. } mus niger.
Purgatrix. Castor oil bean.
Fæcula. Starch. (Amylum.)

Fairoline. Ointment of unknown composition.
Farina Hordei Præparata. Barley flour heated in a steam bath for about thirty hours.
Febricide. Antipyretic. Composition unknown. (Health Restorative Co., New York.)
Ferri Scobs. Iron filings.
Ferro Pagliari. Solution of ferrous chloride.
Ferrugo. Iron rust.
Ferrum Alcoholisatum. Finely powdered iron, which is not the same as reduced iron.
Limatum. Iron filings.
Pomatum (extract, tincture, etc.). Iron malate.
Firwein. Contains bromine, iodine, and phosphorus with balsams. (Tilden & Co., New Lebanon, N.Y.)
Flake White. Carbonate of lead.
Flea Seeds. Seeds of Nigella.
Flores Antimonii. Antimony sesquioxide.
Benzoes. Benzoic acid.
Bismuthi. Bismuth oxide.
Zinci. Zinc oxide.
Flos Æruginis. Copper acetate.
Flos Salis. Sodium subcarbonate.
Fluor Spar. Calcium fluoride.
Flowers of Antimony. Oxide of antimony.
of Benjamin. Benzoic acid.
of Zinc. Oxide of zinc.
Fo-di-ta. A pepsin tablet. (New York & Chicago Chemical Co.)
Formalin. 40 per cent. solution. Formaldehyde. (Antiseptic.)
Formol. Formaldehyde.
Formylum Chloratum. Chloroform.
Fossiline. Similar to petrolatum, vaselin, etc. Vaselin.
Frankincense. Olibanum.
French Polish. An alcoholic solution of shellac.
White. Pulverized talc.
Friar's Balsam. Compound tincture of benzoin.
Fromentin. The embryo of wheat.
Fuligokali. An alkaline solution of soot evaporated to dryness.
Fuller's Earth. A species of clay.
Furfur. Bran.
Fustic, Old. The wood of Morus tinctoria.
Young. The wood of Rhus cotinus.

G.

Galactic. Lactic.
Galena. Lead sulphide.
Gallacetophenone. Methylketotrioxybenzol. Methylketotrioxybenzene. Trioxyacetophenone. Alizarin-yellow "C."
Gallein. Coal-tar color. Used as an indicator.
Gallobromol. Dibromogallic acid.
Gambir. Pale gum catechu.
Gannal's Solution. Solution of aluminum acetate.
Gelatol. Ointment basis, consisting of oil, glycerin, gelatin, and water.
Gentian, White. A German rural domestic medicine, which is dried white dog-dung.
Glacialin. Mixture of borax, boric acid, and sugar (or glycerin).
Glacies. Ice.
Mariæ. Isinglass-stone; Muscovy glass. (A variety of calcium sulphate.)
Glandes Quercus (Tostæ). Acorns. (Acorn coffee.)
Glass Gall. The scum forming on the surface of melting glass.
of Antimony. Vitrified antimony oxide.
Globuli Martiales. A crude iron tartrate in the form of balls or marbles.
Glonoin. Nitroglycerin. Trinitrin.
Glusidum. The official name for saccharin in the Brit. Ph.
Gluten. Glue.
Glycéré (Glycérat) (French). Soft or solid glycerin preparations.
Glycerinum Pepticum. One of Fairchild's pepsin preparations.
Glycerolé (French). Liquid glycerin preparations.
Glyceryl Borate. Boroglyceride.
Glyconin. A mixture of yolk of egg and glycerin.
Glycozone. Probably a solution of hydrogen peroxide in glycerin. (Marchand, New York.)
Gommeline. Crude dextrin.
Grains d'Avignon. French berries (Rhamnus infectorius).
Graphite. Black lead.
Green Vitriol. Ferrous sulphate.
Guaiacolsalol. Guaiacol salicylate. (Intestinal antiseptic.)
Gum Dragon. Tragacanth.
Gummi Elasticum. India rubber.
Guttæ (Gutti). Gamboge.
Rubrum Gambiense. Kino.
Scorpionis. } Gum arabic.
Thebaicum. }
Gunjah. Cannabis Indica.
Gypsum. Plaster of Paris.

H.

Hæmatites. Bloodstone.
Hæmatogen. Iron albuminate, as found in eggs.
Hæmogallol. Produced by the action of pyrogallol upon the coloring matter of blood. Reduction product of hæmatin. Blood-producer.

Hæmol. Produced by the action of zinc-dust upon the coloring matter of the blood. Reduction product of hæmatin. Blood-producer.
Hagiospermus. Santonica.
Hamburg Drops. A kind of "Swedish Bitters."
Tea. Identical with St. Germain tea, differently flavored.
Headine. Mixture of acetanilid and sodium bicarbonate. (Headache cure.)
Heberden's Ink. Aromatic mixture of iron. (*Ph. Dublin.*)
Helianthin. Methyl-orange. (Anilin color.)
Hepar. Liver (of sulphur, antimony, lime, etc.).
Antimonii. An impure antimonium and potassium sulphide.
Sulphuris. Potassa sulphurata. "Liver of sulphur."
Herba Corta. Specialty of Griswold, Hartford, Conn.
Hiera Picra. (Incorrectly, but commonly, called Hicra Picra.) Pulvis aloes et canellæ.
Hill's Balsam of Honey. A tincture of tolu, honey, etc.
Hips. The fruit of dog-rose.
Homberg's Phosphorus. Calcium chloride.
Pyrophorus. A mixture of alum and brown sugar, or of potassium sulphide, alumina, and charcoal.
Huxham's Tincture of Bark. Compound tincture of cinchona.
Hydracetine. Acetophenylhydrazine. Pyrodine. Acetylphenylhydrazine.
Hydrargyri Oxymurias. Corrosive chloride of mercury.
Hydrargyrus Muriatus. Corrosive chloride of mercury.
Hydrastis, Colorless. Solution of hydrastine in glycerin and water. (Keith & Co.)
Hydrochrite. Barley water.
Hydrolat (French). A distilled water.
Hydrolé (French). An aqueous solution.
Hydroleine. A kind of pancreatic emulsion of cod-liver oil. (Crittenden, New York.)
Hydronaphtol. Antiseptic. Said to be different from betanaphtol. (Rigney & Wolff, New York.)
Hydropege. Spring or hydrant water.
Hydrophilous (Hygrophilous) Cotton. Absorbent cotton.
Hygrine. One of the alkaloids of coca.
Hypnal. Chloral-antipyrin. Trichloraldehydphenyldimethylpyrazolone. (Hypnotic.)
Hypnone. Acetophenone. (Hypnotic.)
Hypoderms. Tablets for hypodermic injections. (Allen & Hanbury, London.)

I.

Ichthyocolla. Isinglass.
Ichthyol. Ammonium ichthyol-sulphonate from a peculiar bituminous shale.
Indian Pink. Spigelia marilandica.
Tobacco. Lobelia inflata.
Indicum. Indigo.
Inflammable Air. Hydrogen.
Ingluvin. Pepsin obtained from the crop of chicken.
Injection Brou. A French specialty for gonorrhœa.
Iodol. Pyrrol tetraiodide. Tetraiodopyrrole. (Antiseptic, alterative.)
Iodophenine. Combination of phenacetin with iodine. (Antiseptic.)
Iodophenochloral. Mixture of tincture of iodine, carbolic acid, and chloral hydrate.
Iodopyrine. Iodoantipyrine. Antipyrine monoiodide.
Iron, Alcoholized. Finely powdered iron. It is not the same as iron by hydrogen.
by Hydrogen. Reduced iron.
Nitrogenized. Syrup of iron and sodium albuminates.
Issue Peas. Small orange berries, or round pills turned from orris root.
Izal. By-product obtained in coke-formation. "Thorncliffe disinfectant."

J.

Japan Earth. Catechu.
Jap-Menthol. Menthol from Japanese oil of peppermint.
Jesuits' Bark. Cinchona.
Drops. Contain guaiacum, sarsaparilla, and Peruvian balsam.
Jews' Pitch. Asphaltum.
Judas's Ear. A fungus of elder-tree. (Exidia.)
Jupiter. An ancient name for tin.
Jusculum. Broth (of beef, veal, turtle, etc.).

K.

K. See also C.
Kairine. Oxychinolinethyl hydrochlorate. (Antipyretic.)
"A." Oxyquinolinethylhydride. (Antipyretic.)
Kali Aeratum. Potassium carbonate.
Kalicum Hydras. Fused potassa.
Kalium, Kali. Potassium, potassa.
Kaolin. China clay. A hydrated silicate of alumina.
Kefir. A kind of kumyss.
Kelene. Chelen. Ethyl chloride. (Local anæsthetic.)
Keratin. Horn substance, peptonized.
Kina Kina. Cinchona.
King's Yellow. Yellow arsenic sulphide.

Kochine. Tuberculin.
Kodozonol. Ozonized cod-liver oil. (Ozone Co., New York.)
Kreozonol. Ozonized oil of tar. (Ozone Co., New York.)
Kresin. A solution of cresol in a solution of sodium cresoxyl-acetate. (A 25-per-cent. solution.)
Kresylol. See Cresylol.
Kumysgen. Kumyss in a dry form. (Reed & Carnrick, New York.)

L.

Lac Magnesiæ. Milk of magnesia.
 Virginis. See Virgin's Milk.
Lacca Cœrulea. Litmus.
 Musica (Lakmus). Litmus.
Lactin. Sugar of milk.
Lacto Preparata. A kind of malted milk with cereals, etc. (Reed & Carnrick, New York.)
Lakmoid. Substitute for litmus; a coal-tar color.
Lamium Album. Blind nettle.
Lamotte's Drops. Ethereal tincture of ferric chloride.
Lanadeps. A purified lanolin. (Lloyd & Co., Leicester, England.)
Lanain. Adeps lanæ. Lanolin.
Lana Philosophica. Zinc oxide.
Lanesin. Similar to lanolin.
Lanolin. Purified wool fat emulsified with water. Adeps lanæ. Lanain.
Lapides Cancrorum. Eyestones.
Lapilli Cancrorum. Crab's eyes, crab-stones; concretions found in the stomach of the European crawfish.
Lapis Baptista. Ancient name for talcum.
 Calaminaris. Impure zinc carbonate.
 Causticus. Potassa. (In sticks.)
 Cœruleus. Copper sulphate.
 Divinus. Copper aluminate.
 Hæmatites. Bloodstone.
 Infernalis. Lunar caustic. (Fused silver nitrate.)
 Lazuli. Ultramarine.
 Smiridis. Emery.
Latrol. A substitute for iodoform. By the action of iodine upon one of the anilines. (Clinton Pharm. Co., Syracuse, New York.)
Ledoyen's Disinfecting Liquid. Solution of nitrate of lead.
Lenitive Electuary. Confection of senna.
Leucœnus. White wine.
Leucogene. Sodium bisulphite.
Levant Nut. Cocculus Indicus. (Fish berries.)
Lichen Islandicus. Iceland moss.
Life-Everlasting. Gnaphalium polycephalum.
Lignia Nitrica. Gun-cotton.
Lignum Sanctum. Guaiacum wood. (Lignum vitæ.)
 Vitæ. Guaiacum wood.
Limatura Ferri. Iron filings.
Linonine. Compound emulsion of linseed oil. (Danbury Pharm. Ass., Conn.)
Lintine. Absorbent cotton in thin sheets. (Johnson & Johnson, New York.
Lipanin. An olive oil containing 6 per cent. of free oleic acid. (Alterative.)
Liquor Anodynus (Hoffmanni). Hoffmann's anodyne.
 Cornu Cervi (Liquor C.C.). Solution of ammonium carbonate, containing empyreumatic oil.
 Cornu Cervi Succinatus (Liquor C. C. Succinatus). Solution of ammonium succinate.
 Ferri Oxychlorati. Dialyzed iron.
 Fumans Boylii. Ammonium hydrosulphide.
 Salicylicus, Sellers's. Contains sodium and quinine salicylates and salicin.
 Seriparus. Liquid rennet.
 Stypticus Loofii. Solution of ferric chloride.
 Tongæ Salicylatus. See Tongaline.
Listerine. Antiseptic. Contains borax, thymol, eucalyptol, oils of wintergreen and peppermint.
Lithiated Hydrangea. Kidney remedy. Contains hydrangea and lithium benzo-salicylate. (Lambert Co., St. Louis.)
Lithines. Lithia water tablets. (Metcalf & Co., Boston.)
London Paste. Soda with lime.
Looch Album. An emulsion of almonds and oil of almonds.
Loofah. "Vegetable sponge;" the skeleton of a gourd.
Losophan. Triiodometacresol. Triiodometacresylic acid. (Antiseptic dermic.)
Love-Apple. Tomato.
Luna. Silver.
Lysol. Mixture of cresols with soap. (Antiseptic.)

M.

Magisterium Bismuthi. Bismuth subnitrate.
 Coccionellæ. Carmine.
 Sulphuris. Washed sulphur.
Magnesia Alba. Magnesium carbonate.
 Nigra. Black manganese oxide.
Mala. Poma (apple).
Mallein. A product of the "epizootic" bacilli, prepared by Adamkiewicz. Alexine of glanders, according to Adamkiewicz.
Marcasita. Metallic bismuth.

Marine Acid. Hydrochloric acid.
Salt. Sodium chloride.
Mars, or Martis. Iron (Tinctura Martis is tincture of iron).
Massicot. Lead protoxide.
Mater Metallorum. Mercury.
Matta. The cortical portion from a variety of millet-seed, used for adulterating pepper.
Maw-Seed. Poppy-seed.
Meadow Saffron. Colchicum.
Meconium. The juice of the poppy.
Medulla Bovis. Ox-marrow.
Lactis. Butter.
Sassafras. Sassafras pith.
Mel Ægyptiacum. Liniment of copper.
Melanosmegma. Soft (green) soap.
Meleguette Pepper. Grains of Paradise.
Mellite (French). A honey.
Mephite of Soda. Impure sodium carbonate.
Mercure Précipité Blanc (French). White precipitate.
Mercurius Dulcis. Calomel.
Præcipitatus Albus. A name for calomel.
Mortis. } Antimony oxide.
Vitæ. }
Mercury Alanin. Mercury amidopropionate.
Hahnemann's Soluble. Black mercury oxide.
Methacetine. Paraacetanisidine. Paraoxymethylacetanilid. Acetylmethylparamidophenol. (Antipyretic.)
Methanilid. Exalgin.
Metheglin. Honey wine. Mead.
Methonal. Dimethylsulphonedimethylmethane.
Methozin. Antipyrin.
Methylal. Methylenedimethylic ether. (Anæsthetic.)
Metol. Salt of monomethylparaamidometacresol (for photographic uses).
Metopium. Expressed oil of almonds.
Metozin. Antipyrin.
Metrenchyta. Vaginal injection; sometimes a vaginal syringe.
Mica Panis. Bread crumb.
Microcidin. Sodium betanaphtol. Sodium betanaphtolate (75 per cent.). (Antiseptic.)
Microcosmic Salt. A mixture of sodium and ammonium phosphates.
Mikozone. Hypnotic and sedative. (A variety of chlorodyne).
Milk of Sulphur. Precipitated sulphur. (Strictly only that precipitated by sulphuric acid.)
Virgin's. Rose-water rendered milky by the addition of tincture of benzoin.
Mineral Gum. Soluble glass; sodium or potassium silicate.
Minium. Red lead.
Græcorum, Minium Purum. Red mercuric sulphide.
Miraculum Chemicum. Magnesium carbonate.
Mithridate. See Confectio Damocratis.
Mistura Acaciæ. Mucilage of gum arabic of variable strength.
Oleoso-Balsamica. An alcoholic solution of Peru balsam, oil of amber, and sundry volatile oils.
Mixtura Alba. Compound chalk mixture.
Salina. Potio Riveri. (Effervescent mixture of potassium citrate.)
Solvens. Solution of ammonium chloride with liquorice.
Solvens Stibiata. Solution of ammonium chloride with liquorice and tartar emetic.
Mixture, Antidysenteric. Acid camphor mixture.
Dysmenorrhœa. Guaiac mixture with corrosive sublimate.
French. Carbolized solution of iodine.
Gadberry's. Acid mixture of quinine and iron.
Griffith's. Compound mixture of iron.
Hope's. Acid camphor mixture.
Mollin. Ointment basis, consisting of a glycerin soap containing an excess of fat or oil.
Mollisin. Ointment basis of 4 parts of paraffin oil and 1 part of yellow wax.
Molybdos. Lead.
Morrhuol. Alcoholic extract of cod-liver oil.
Mosaic Gold. Tin bisulphide.
Mosquera Preparations. Contain meat digested by pine-apple juice. (Parke, Davis & Co., Detroit, Mich.)
Mountain Fat. Paraffin.
Muride. } Bromine.
Murina. }
Muscus. Moss. (Iceland, Irish, etc.)
Myrrholin. Solution of myrrh in castor oil, equal parts. (Alterative.)

N.

Naphæ Flores (Aqua). Orange flowers (water, etc.).
Naphtha. Prescribed by English physicians, means pyroxylic and pyroacetic spirits. In German prescriptions it means ether; often written naphtha vitrioli.
Vitrioli. Ether.
Naphthalol. Betol.
Naphthopyrin. Combination of betanaphtol with antipyrin.
Naphthosalol. Betol.
Naphthyl. Naphtol.

Natrium, Natron. Sodium, soda.
Natro-Kali Tartaricum. Rochelle salt.
Neapolitan Ointment. Mercurial ointment.
Neogale. Fresh milk.
Nepenthe. A preparation of opium. (Ferris & Co., Bristol, England.)
Nico. Nickel carbonmonoxide.
Nigramentum. Black ink.
Nihil Album. Crude zinc oxide.
  Griseum. Zinc oxide.
Nitratine. Sodium nitrate.
Nitre, Rough. Magnesium chloride.
Nitrobenzin. } Artificial oil of bitter
Nitrobenzol. } almonds.
Nitrum Flammans. Ammonium nitrate.
  Saturninum. Lead nitrate.
Nix Zinci. Zinc oxide.
Number Six. Tincture of capsicum and myrrh. (Hot drops.)
Nutrolactis. A galactagogue. (Nutrolactis Co., New York.)
Nux Aromatica. Nutmeg.
  Metella. Seed of Strychnos nux vomica.
  Moschata. Nutmeg.

O.

Œnanthic Ether. Artificial oil of cognac.
Œsipus. Suint. Impure wool fat.
Oil, "American." Scandinavian for castor oil.
  of Bay. Oil of laurel berries. (Generally is understood to mean oil of bay rum.)
  of Ben (or Behen). Comes from a Moringa, and is not the same as oil of benne, which comes from a Sesamum.
  of Cassia, Artificial. Probably camphor oil, or neutral oil perfumed with oil of cassia.
  Colza. Oil of rapeseed.
  Dagget. Empyreumatic oil of birch. (Oil of Russia leather.)
  Dippel's. Rectified oil of hartshorn.
  of Eggs. By expression from hard-boiled yolks.
  Leaurelle. A preparation for the complexion. (Proprietary.)
  Lucca. A brand of good olive oil.
  of Niobe. Methyl benzoate.
  St. Jacob's. A liniment. (Specialty of Vogeler, Baltimore.)
  Seneka. Crude petroleum.
  of Smoke. Creosote.
  Swallow. Infused oil of elder flowers.
  of Tartar. Solution of potassium carbonate.
  of Vitriol. Sulphuric acid.
Ointment, Black Basilicon. Basilicon ointment with pitch.
  Maury's. A compound rhubarb ointment.
  Volatile. Volatile liniment.
Oleite. Sodium sulphoricinoleate.
Oleosa. A special brand of eucalyptus oil. (Drysdale & Co., London.)
Oleum Animale Fœtidum. Crude oil of hartshorn.
  Anthos. Oil of rosemary.
  Betulinum. Empyreumatic oil of birch. (Oil of Russia leather.)
  Bubulum. Neatsfoot oil.
  Cadinum. Empyreumatic oil of juniper.
  Camphoratum. Liniment of camphor.
  Castoris. Castor oil. (Has nothing to do with castoreum.)
  Cedræ (de Cedro). Oil of lemon.
  Chaberti. Rectified animal oil.
  Chamomillæ Citratum. Oil of lemon, distilled over German chamomile.
  Cocois. Oil of cocoanut.
  Coctum. Fixed oil (olive oil) infused with the respective herb, etc.
  Cornu Cervi (Fœtidum). Crude animal oil.
  Fermentationis. Fusel oil.
  Juniperi Oxycedri (Empyreumaticum). Oil of cade.
  Laurinum. Expressed oil of laurel berries.
  Lumbricorum. Infused oil of earthworms.
  Napi. Rapeseed oil.
  Nucis Moschatæ. Besides the two kinds of oils (volatile and fixed) see also Balsam Nucistæ.
  Nucistæ. Expressed or volatile oils of numeg.
  Palmæ Christi. Castor oil.
  Petræ. Crude petroleum. (Seneka oil.)
  Philosophorum. Olive oil distilled over hot bricks.
  Portugallicum. Oil of bergamot.
  Rusci. Empyreumatic oil of birch. (Oil of Russia leather.)
  Tartari per Deliquium. Concentrated solution of potassium carbonate.
  Templinum. Oil of pine cones and small branches of Pinus pumilio.
Onguent (French). Ointment which contains resin.
Opodeldoc, Steers's. Solid opodeldoc.
Orellana. Arnotta.
Orexin. Phenyldihydrochinazoline hydrochloride. Phenyldihydroquinazoline. (Appetizer)
Orleana. Annotta.

Orthine. Orthohydrazineparaoxybenzoic acid. (Antiseptic, antipyretic.)
Oryza. Rice.
Os Sepiæ. Cuttlefish bone.
Oxalium. Potassium binoxalate.
Oxychinaseptol. Orthophenolsulphonate of oxychinoline.
Oxy-di-methyl-chinizin. Antipyrin.
Oxygen Powder. Sodium peroxide containing 20 per cent. active oxygen. (Bleacher.)
Oxymel. Honey boiled with vinegar.
  Æruginis. Honey with copper acetate.
Oxymellite (French). Honey with vinegar.
Ozokerite. Earth-wax; an impure paraffin.

P.

Palacetyrus. Old cheese.
Palatinoid. Gelatin capsule with dry powder.
Panacea Mercurialis. Calomel.
Panchymagogum Minerale (P. Quercitani). Calomel.
Pancro-Bilin. Ox-gall and pancreatin (Reed & Carnrick, New York.)
Pan-Peptic Preparations. Specialty of Sharp & Dohme, Baltimore.
Papine. A preparation of opium. (Battle & Co., St. Louis.)
Papoid. Digestive principle of the fruit of Carica papaia. (Johnson & Johnson, New York.)
Paraffinum Molle. Petrolatum.
Paris Green. Copper arsenite.
Parodyn. Antipyrin.
Passulæ. Raisins.
  Minores. Corinthian raisins. (Grocers' "currants.")
Pasta Cerata. Ointment basis, consisting of yellow wax, water, and potassium carbonate.
Peacock's Bromides. Contains potassium, sodium, calcium, ammonium, and lithium bromides. (St. Louis.)
Pearl White. Bismuth subnitrate.
Pelletierine. Alkaloid of pomegranate bark.
Pental. Trimethylethylene. Betaisoamylene. (Anæsthetic.)
Pepperette. Olive pits. (For adulterating pepper.)
Pepsalia. A peptic salt (probably pepsin and salt) for table use. (Stern, London.)
Perloids. A style of capsules. (Proprietary.)
Persio. Cudbear.
Phenacetine. Paraacetophenetidine. Phenin. Oxyethylacetanilid. (Antipyretic, anodyne.)
Phenates. Carbolates.
Phenazone. Antipyrin.
Phenetidin. Phenacetin.
Phenetol. Ethyl phenate.
Phenic Acid. Carbolic acid.
Phenin. Paraacetophenetidine. Phenacetin.
Phenocoll. Amidoacetoparaphenetidine. Glycocoll-paraphenetidine. (Antipyretic.)
Phenolid. Mixture of acetanilid and sodium salicylate. (Antipyretic, anodyne.)
Phenolin. Mixture of soap with cresols.
Phenolphthalein. A coal-tar color. Indicator in analysis.
Phenolsulphonate. Sulphocarbolate.
Phenopyrin. Combination of carbolic acid with antipyrin.
Phenosalyl. Mixture of carbolic acid, salicylic acid, lactic acid, menthol, and eucalyptus oil. (Antiseptic.)
Phenyl. Phenol.
Phenylacetamide. Acetanilid, *U. S. P.*
Phenyl-di-methyl-iso-pyrazolon. Antipyrin.
Phenyl-di-methyl-pyrazolon. Antipyrin.
Phenylic Acid. Carbolic acid.
Phenylone. Antipyrin.
Phosphin. A coal-tar color. Chrysanilin nitrate.
Photoxylin. Similar to gun-cotton, but made from wood-pulp.
Phyllis Amara. Bitter almond bran.
Physostigmine. Eserine.
Phytoline. Antifat. From poke berries by a peculiar process. (Walker Pharm. Co., St. Louis.)
Pichi. Fabiana imbricata.
Picrol. Diiodoresorcinmonosulphonic acid.
Picropyrin. Combination of picric acid with antipyrin.
Pills, Eternal. Pills of metallic antimony, about 15 grains each, which, after use, were recovered from the stools and washed.
  Lapactic. Sharp & Dohme's specialty. (Baltimore.)
  Perpetual. See Pills, Eternal.
Pinguedo. Lard.
Pinguoleum. Fixed oil.
Pink Powders. Contain calomel and sugar, colored with a little carmine.
  Saucer. The coloring matter is derived from safflower.
Pinus Canadensis, Kennedy's. Dark: compound fluid extract of Pinus canadensis. White: compound solution of zinc sulphate.
Piperazidin. Piperazin.
Piperazin. Diethylendiamine. Ethylenimine. (Uric acid solvent.)
Pip-Menthol. Menthol from American and European oil of peppermint.

Pisselæum Indicum. Petroleum.
Plasma. Glycerite of starch.
Plasment. Basis for urethral injections. A slimy solution of Irish and Iceland moss with admixture of glycerin and benzoin.
Plaster, Diachylon. Lead plaster.
Nuremberg. Brown plaster. Mother plaster.
Platt's Chlorides. Contains aluminum, sodium, zinc, and calcium chlorides.
Plumbago. Black lead. Also a genus of herbs.
Plumbum Album. Tin.
Scytodepsicum. Moist lead tannate.
Plutonium. Barium.
Poivrette. Olive pits; adulterant of pepper.
Polysolve. Alkaline salts of sulpholeic acid.
Poma Aurantii (-iorum). Orange buds.
Pommade (French). Ointment which does not contain resin.
Pompholix. Zinc oxide.
Pond's Extract. A private make of "distilled extract of witch-hazel" (hamamelis).
Potash for Gargling. Potassium chlorate.
Potassium Chromate (neutral). Yellow potassium chromate.
Hydriodate. Potassium iodide. (Kalium hydro-iodicum of German prescriptions.)
Rhodanate. Potassium sulphocyanide (-cyanate).
Pot-Pourri. Fumigating species, chiefly flowers, generally preserved with salt.
Powder, Digestive. Compound powder of pepsin. (Proprietary.)
of Algaroth. Antimony oxide.
Précipité Blanc (French). This, in French prescriptions, for internal use, is calomel (by the wet process), and for external use it generally means white precipitate.
Primuline. Sodium thioparatoluidine-sulphonate.
Prussian Blue. Iron ferrocyanide.
Pulvis Ærophorus. Effervescing powder. (Soda, Seidlitz.)
Diatragacanthæ. Starch, liquorice root, gum arabic, and sugar.
Digestivus. Rhubarb, saltpetre, and cream of tartar.
Gummosus. See Pulvis Diatragacanthæ.
Infantum. When for internal use: magnesia and rhubarb, with oil of fennel. When for external use: baby dusting-powder.
Jacobi. Antimonial powder.
Puerorum. See Pulvis Infantum (internal use).
Pumiline. A distillate from Pinus pumilio, in a variety of forms. (Stern, London.)
Punicine. Pelletierine; alkaloid of pomegranate bark.
Purple of Cassius. Gold precipitated from solution by tin chloride.
Putty Powder. Polishing substance. Tin oxide.
Putz Pomade. A polishing ointment, containing ferric oxide, and probably pumice-stone.
Pyoktanin, Blue. Methylviolet.
Yellow. Auramine.
Pyracine. Antipyrin.
Pyrazolone. Antipyrin.
Pyretin. A new antipyretic of, as yet, unknown composition.
Pyrodine. Acetophenylhydrazine. Hydracetin. Acetylphenylhydrazine.
Pyrœnus. Alcohol.
Pyrogallopyrin. Combination of pyrogallol with antipyrin.
Pyrolignine. A "ligneous" (*sic*) product from wood tar. (Borst, Montreal, Canada). (Antipyretic.)
Pyrophorus. A mixture of certain substances which ignite spontaneously when exposed to the air.
Pyroxylin. Gun-cotton.
Pyrozole. One of the coal-tar chemicals. (Pyrozole Chem. Co., St. Louis.) (Antipyretic.)
Pyrozone. Hydrogen peroxide rendered permanent in ether. (Specialty, McKesson & Robbins, New York.)

Q.

Quaker Button. Nux vomica.
Quaker's Black Drop. Vinegar of opium.
Quassation. In pharmacy, the act of reducing roots and tough barks to morsels.
Quévenne's Iron. Iron reduced by hydrogen.
Quickine. A solution of 1 part of carbolic acid and 0.02 part of mercuric chloride in 100 parts of dilute alcohol.
Quickwater. Solution of mercuric nitrate.
Quinine, Amorphous. The ether soluble part of quinoidine.
Quinole. Hydroquinone (for photographic purposes).

R.

Radical Vinegar. Glacial acetic acid.
Raisins, Corinthian. Grocers' currants.
Ramenti Ferri. Iron filings.
Realgar. Red arsenic sulphide.
Reddle. Red chalk.

Regulus (Antimonii, etc.). The pure metals, when separated by fusion.

Resina Elastica. India rubber.
- **Empyreumatica Liquida.** Tar.
- **Empyreumatica Solida.** Pitch.
- **Flava.** Rosin. (Colophony.)
- **Pini.** Turpentine (solid, hard).

Resopyrin. Compound of resorcin and antipyrin.

Resorcinol, Resorcin. This name has also been given to the fused product of resorcin and iodoform. (Bielaiew.)

Resorcinopyrin. Combination of resorcin and antipyrin.

Retinol. Rosin oil. Rosinol. Resinol. (Antiseptic, astringent.)

"Rex." Extract of beef of Cudahy, Omaha, Neb.
- **Metallorum.** Gold.

"Rham. Cat." Abbreviation of Rhamnus catharticus. (Buckthorn berries.)

Rizoline. Artificial oil of turpentine.

Rizine. Rice, partially acted upon by superheated steam.

Rob (Roob). Inspissated juice (of elderberries, carrot, juniper berries, etc.).

Rodinal. Paraamidophenol. (For photographic purposes.) Solution of paraamidophenol hydrochlorate, sodium sulphite, and potassa in water.

Rose Pink. Whiting colored with decoction of Brazil wood and pearl ash.

Rosinol. Rosin oil.

Rotterin. Antiseptic solution, containing zinc chloride and sulphocarbolate, salicylic acid, boric acid, citric acid, thymol, and sodium chloride. Also in pastilles.

Rotulæ. Lozenges.

Rouge. Red ferric oxide.
- **Card.** Sodium carthamate, from safflower.

Rubigo Ferri. Iron-rust.

Rubramentum. Red ink.

Ruddle. A kind of red chalk.

Rufus's Pills. Pills of aloes and myrrh.

Rusot. Extract of Berberis lycium.

S.

Sacchari Fœx. Molasses.

Saccharin. Orthosulphamidobenzoic anhydride. Benzoyl sulphonicimide. (Sweetener.)

Saccharolé (French). Any moist liquid preparation (except syrup) which contains sugar in large proportions.

Saccharum Acernum. } Maple sugar.
- **Canadense.** } Maple sugar.
- **Candum** (Candisatum). Rock candy.
- **Saturni.** Sugar of lead.

Saccharure (French). Dry saccharolé; medicated sugars.

Saffranin. A coal-tar color.

Saffrol. A concentrated oil of sassafras; now mostly obtained from oil of camphor.

Saffron, American. Safflower.

Saim. Adeps.

Sal Absinthii. Potassium carbonate.
- **Acetosellæ.** Potassium oxalate. (Generally oxalic acid is expected.)
- **Æratus.** Potassium carbonate.
- **Alembroth.** A mixture of mercuric and ammonium chlorides.
- **Amarum.** Magnesium sulphate.
- **Ammoniacum Martiale.** Iron ammonio-chloride.
- **Ammoniacum Secretum Glauberi.** Ferrous sulphate.
- **Ammoniacum Volatile.** Ammonium carbonate.
- **Anglicum.** Magnesium sulphate.
- **Argenti.** Silver nitrate.
- **Armeniacum.** Ammonium chloride.
- **Artis.** A mixture of mercuric and ammonium chlorides.
- **Benjamin.** } Benzoic acid.
- **Benzoin.** } Benzoic acid.
- **Catharticus Amarus.** Magnesium sulphate.
- **Catharticus Anglicanus.** Magnesium sulphate.
- **Catharticus Glauberi.** Sodium sulphate.
- **Chalybis.** Iron sulphate.
- **Cornu Cervi.** Ammonium subcarbonate.
- **de Duobus.** Potassium sulphate.
- **Diureticus.** Potassium acetate.
- **Enixum.** Potassium bisulphate.
- **Essentiale Tartari.** Tartaric acid.
- **Fossilis.** Sodium chloride.
- **Fuliginis.** Ammonium carbonate.
- **Gemmæ.** Sodium chloride.
- **Lactis.** Milk sugar.
- **Marinum.** Sea salt.
- **Martis.** Ferrous sulphate.
- **Microcosmicum.** Salts of urine.
- **Mirabile Glauberi.** Sodium sulphate.
- **Mirabile Perlatum.** Sodium phosphate.
- **Nitrum.** Potassium nitrate.
- **Ossium.** Ammonium carbonate.
- **Panchrestum.** Potassium tartrate.
- **Petræ.** Potassium nitrate.
- **Polychrestum Seignetti.** Sodium tartrate.
- **Polychrestus.** Potassium sulphate.
- **Polychrestus Glaseri.** Potassæ sulphas cum sulphure.
- **Prunelle.** Potassium nitrate.
- **Rupellensis.** Rochelle salt.
- **Sapientiæ.** Sal alembroth.
- **Saturni.** Lead acetate.
- **Scientiæ.** Sal alembroth.
- **Sedativus Hombergi.** Boracic acid.

Sal Sedlicensis. Magnesium sulphate.
Sennerti. Potassium acetate.
Seydschutzense. Magnesium sulphate.
Succini. Succinic acid.
Tartari. Potassium carbonate.
Tartari Essentiale. Tartaric acid.
Thermarum (Carolinarum). Carlsbad salt.
Urinæ. Sodium phosphate.
Vegetabile. Potassium tartrate.
Vitæ. Sal alembroth.
Vitrioli. Zinc sulphate.
Vitrioli Narcoticum. Boracic acid.
Volatile. Ammonium carbonate.
Volatile Liquid. Ammonia water.
Vomitorium Vitrioli. Zinc sulphate.
Salacetol. Salicylacetol. (Antirheumatic.)
Salamander's Blood. Fuming nitric acid.
Salbromalide. Antinervine.
Salicyl-Bromanilide. Antinervine.
Salinaphtol. Betol.
Saliphene. Salicylphenetidine.
Salipyrin. Antipyrin salicylate.
Salitonia. A saline tonic. (Phenique Chem. Co., St. Louis.)
Salmiac. Ammonium chloride.
Salol. Phenyl salicylate. Phenol salicylate. Phenylic ether of salicylic acid.
Salophene. Acetylparaamidosalol. (Antirheumatic.)
Salt, Fruit. A variety of Seidlitz (or Seltzer) aperient.
Herapath's. Quinine iodosulphate.
Microcosmic. Sodium and ammonium phosphate.
Seignette. Rochelle salt.
Sore-Throat. Sal prunellæ.
of Tartar. Pure potassium carbonate.
of Tin. Tin chloride.
Salve Pencil. Ointment in the shape of a pencil or stick.
Sandiver. See Glass Gall.
Sandyx. Red lead oxide.
Sanmetto. A combination of santal oil and saw-palmetto. For bladder-complaints. (Od. Chem. Co., New York.)
Santal Midy. Gonorrhœa capsules of Grimault & Co., in Paris.
Santoninoxim. Derivative of santonin.
Sapo Medicatus. A good quality of neutral white Castile soap.
Sapocarbol. Mixture of cresols with soap. (Antiseptic.)
Saponiment. A kind of compound soap liniment.
Saprol. Mixture of crude cresols with hydrocarbons. (Antiseptic.)
Sarco-Peptones. Specialty of Rudish. (Meat peptone.)
Saturatio. Solution of sodium citrate.
Saturnus (Saturni). Lead.
Schweinfurth's Green. Copper arsenite.
Sea-Onion. Squill.
Sebum (Sevum). Suet. Tallow.
Sedatine. Antipyrin. Also applied to paravalerylamidophenetol. (A new sedative.)
Sedox. A new dressing for wounds, etc., similar to cotton.
Seignette's Salt. Rochelle salt.
Semen Contra. Wormseed from Barbary.
Semen Cynæ. Santonica. Levant wormseed.
Sanitum. The seed of Artemisia santonica.
Semencina. Levant wormseed. (Santonica.)
Semina Strychni. Nux vomica.
Serosine. Bromo-anilid. (Antipyretic.) (Serosine Chem. Co., St. Louis.)
Serum (Lactis, etc.). Whey (milk, etc.).
Sideros. Iron.
Siliqua Dulcis. St. John's bread.
Sodæ Azotas. Sodium nitrate.
Sol. Gold.
Soluble Glass. Sodium or potassium silicate.
Solution, Goadby's. A preserving solution for animal substances, containing salt, corrosive sublimate, and arsenic.
Solutol. A solution of sodium cresolate in excess of cresol. Solution of cresols in sodium cresylate. (Disinfectant.)
Solveol. A solution of cresolene in sodium salicylate. Solution of cresols in sodium cresotate. (Surgical antiseptic.)
Solvin. See Polysolve.
Somnal. Solution of chloral hydrate and urethane in alcohol.
Sozal. Aluminum salt of paraphenolsulphonic acid.
Sozoiodol (difficultly soluble). Potassium salt of diiodoparaphenolsulphonic acid.
Mercury, Zinc, etc. The respective salts of diiodoparaphenolsulphonic acid.
Sozoiodol (easily soluble). Sodium salt of diiodoparaphenolsulphonic acid.
Spanish White. Bismuth subnitrate.
Sparadrap. Spread adhesive plaster.
Spathum Fluoricum. Fluor-spar.
Species Pectorales. Pectoral species. ("Breast tea.")
Spelter. Zinc.
Speltrum. Zinc.
Sperma Mercurii. Mercury acetate.
Spermine. An aqueous infusion obtained from the prostate gland and testicles of animals. (Nerve tonic.)
Spina Cervina (Baccæ, etc.). Buckthorn berries, etc.

Spirit of Nitre. Crude nitric acid.
Pyro-Acetic. Acetone.
of Salt. Crude muriatic acid.
of Turpentine. Oil of turpentine.

Spiritus. See also Liquor.
Inflammabilis. Alcohol (sometimes whiskey).
Juniperi. Generally gin.
Lethalis. Carbonic acid.
Mindereri. Solution of ammonium acetate.
Muriatico-Æthereus. Spirit of chloric ether. (Not that containing chloroform.)
Muriatico-Æthereus Martiatus. Tinctura ferri chloridi ætherea.
Nitri Dulcis. Sweet spirit of nitre.
Nitri Duplex. } Nitric acid.
Nitri Fumans. } Nitric acid.
Nitri Glauberi. } Nitric acid.
Nitrico-Æthereus. Sweet spirit of nitre.
Odoratus. Cologne.
Pyroxylicus. Methylic alcohol.
Sacchari. Rum.
Salis Dulcis. Spirit of chloric ether. (Not that containing chloroform.)
Salis Fumans. Muriatic acid.
Sulphurico-Æthereus. Spirit of ether. (Hoffmann's drops.)
Veneris. Acetic acid.
Vitrioli. Diluted sulphuric acid.
Vitrioli Dulcis. Hoffmann's anodyne.

Spodium. Crude bone charcoal. (Ivory-black.)

Spritz. A laboratory wash-bottle.

St. Germain Tea. Contains senna, manna, elder-flowers, and fennel or anise.

Stannum Cinereum. } Bismuth.
Glaciale. } Bismuth.
Indicum. Zinc.

Steapsin. Emulsifying ferment of the pancreatic juice.

Stearin. Stearic acid.

Steel Mixture. Mistura ferri composita.

Stibio-Kali Tartaricum. Tartar emetic.

Stibium. Antimony.

Stilus (Stylus). Ointment in the shape of pencil or stick.

Stipites Dulcamaræ. Dulcamara.

Storax Calamita. Solid storax. (Generally sawdust or residue of cinchona preparations mixed with liquid storax.)

Stoughton's Elixir. Compound tincture of gentian.

Stypteria. Alum.

Styracol. Guaiacol cinnamate. Cinnamylguaiacol. (Antiseptic.)

Styrone. Cinnamyl alcohol.

Succata. "Citron" of the grocers.

Succinum (Oleum, etc.). Amber. (Oil, etc.)

Succolata. Chocolate.

Sucrate (French). A saccharate.

Sucrol. Paraphenetolcarbamide. (Sweetener.)

Suffitus. Fumigation.

Sugar Sand. Crude milk sugar.

Suint. Œsipus. Impure wool fat. (Antiseptic.)

Sulphaminol. Thio-oxydiphenylamine.

Sulphas Americanus Australis. Quinine sulphate.

Sulphonal. Diethylsulphonedimethylmethane. (Hypnotic.)

Sulphur Antimoniatum Fuscum. Precipitated sulphuret of antimony.
Auratum. Golden sulphur. (Antimony sulphide.)
Nigrum. Impure native sulphur.
Stibiatum Rubrum (Rubeum). Kermes mineral, antimony, sulphide and oxide.
Vivum. Impure native sulphur.

Sydenham's Laudanum. Wine of opium.

Syrup, Cuisinier. Compound syrup of sarsaparilla.
of Figs. A kind of compound syrup of senna. (California Fig Syrup Co., San Francisco.)

Syrupus Communis. Molasses.
Diacodii. Syrup of poppy-heads.
Domesticus. Syrup of buckthorn berries. (Generally molasses.)
Empyreumaticus. Molasses.
Fuscus. Molasses.
Hollandicus. Molasses.

T.

Tabloids. English name for compressed tablets.

Taffetas. Plaster spread on silk and similar thin fabrics.

Tartarus. Crude potassium bitartrate (argols). Then, several potassium salts.
Boraxatus. Potassium and sodium borotartrate.
Natronatus. Rochelle salt.
Tartarisatus. Potassium tartrate.
Vitriolatus. Potassium sulphate.

Terebinthina Cocta. Turpentine (hard, solid).

Terra Cariosa. Rotten-stone.
Foliata. Sulphur.
Foliata Mineralis. Impure sodium carbonate.
Foliata Tartari. Potassium acetate.
Fullonica. } Fuller's earth.
Fullonum. } Fuller's earth.
Japonica. Catechu.
Ponderosa. Natural barium sulphate.
Sigillata (Alba, Rubra). White and red bole.

Terraline. A preparation from petroleum products, for internal use. (Terraline Co., Washington, D.C.)
Tetraiodpyrrol. Iodol.
Tetronal. Diethylsulphonediethylmethane. (Hypnotic.)
Thebaicum. Containing opium.
Therapol. Ozonized vegetable oils. (Ozone Co., New York.)
Theriaca. Molasses.
Theriaca Andromachi. An aromatic astringent confection containing opium, which originally had more than 70 ingredients.
Thermine. Tetrahydrobetanaphthylamine. Tetrahydrobetanaphtholamine. (Heat producer.)
Thilanin. Compound of sulphur with lanolin. (Dermic.)
Thioform. Basic bismuth dithiosalicylate. (Antiseptic.)
Thiolin. Salts of thiosulphonic acid. Salt of thiolinic acid. Sulphonated and sulphurated linseed oil.
Thiolo. Ammonium salt of thiosulphonic acid. Thiol. Artificial ichthyol.
Thiosinamine. Allylsulphocarbamide; by the action of ammonia upon volatile oil of mustard. (Thorncliffe disinfectant.) See Izal.
Thymacetin. Oxethylacetamidothymol. (Analgetic.)
Thymolol. Aristol.
Tincal. Native borax.
Tinctura Hiera. Wine of aloes.
Japonica. Tincture of catechu.
Melampodii. Tincture of black hellebore.
Thebaica. Tincture of opium.
Tincture, Antacrid. Guaiac mixture with corrosive sublimate.
Antiperiodic. A kind of Swedish bitters with quinine.
Bestucheff's. Ethereal tincture of ferric chloride.
Huxham's. Compound tincture of cinchona with saffron.
Simulo. Tincture of the seeds of Capparis coriacea. (Nervine.)
Tolphite. A dusting-powder containing talcum. (England.)
Tolypyrin. A new antipyretic. Paratolyldimethylpyrazolone.
Tolysal. A compound of tolypyrin with salicylic acid.
Tongaline. Contains tonga, cimicifuga, colchicine salicylate, pilocarpine salicylate, according to Mellier Co., St. Louis.
Tonquinol. Trinitroisobutyltoluol. Substitute for musk.
Tous-les-mois. Canna starch.
Traumaticine. Solution of gutta-percha.
Treacle. Originally "Theriac." In English prescriptions it means "molasses."
Treacle, Venice. See Theriaca Andromachi.
Trefusia. A natural iron albuminate.
Tribromhydrine. Allyl tribromide.
Trifolium Fibrinum. Menyanthes. (Buckbean. Bogbean.)
Tri-Iodides, Henry's. For rheumatism. (Renz & Henry, St. Louis.)
Trimethylamine. Is not exactly the same as propylamine, though often prescribed thus.
Trional. Triethylsulphonmethylethylmethane. Diethylsulphonomethylethylmethane. (Hypnotic.)
Trip. Iron subcarbonate.
Tritica. A kidney remedy. Probably a preparation of Triticum repens. (Searles & Hereth, Chicago.)
Trypsin. Peptonizing ferment of the pancreatic juice.
Tuberculin. A product of the tubercle-bacilli, according to Koch.
Tuberculocidin (shortened "T. C.," or Alexine "T. C."). Purified tuberculin, according to Klebs.
"E." Mixture of tuberculin (Koch) and tuberculocidin (Klebs), according to Spengler.
Tumenol. A preparation of tumenol-sulphonic acid.
Powder. Also a preparation.
Turbeth Mineral. Yellow mercuric sulphate.
Turionis Pini. Pine cones.
"Turps." Oil of turpentine.
Tusche. India ink.
Tushy-stone. A gray zinc oxide.
Tutia. Impure zinc carbonate or oxide.
Tutty. Impure zinc oxide.

U.

Ultramarine. German blue.
Unction. Mild mercurial ointment.
Unguentum Ægyptiacum. Honey with acetate of copper.
Cerussæ Acetatæ (P. L. 1787). Cerate of lead acetate.
Diapompholygos. Ointment of impure zinc oxide.
Myrrhæ. Ointment basis: 1 part of myrrh and 10 parts of wax melted together with oil.
Nervinum. Compound ointment of rosemary.
Ophthalmicum. A mild ointment of mercuric oxide.
Quercinum. Soft (moist) lead tannate.
Scytodepsicum. Moist lead tannate.
Uralin. Uralium.
Uralium. Chloral-urethan. Uralin.
Urethane. Ethyl-carbamate.

Uricedin-Stroschein. Compound, containing in 100 parts 27.5 sodium sulphate, 1.6 sodium chloride, 67 sodium citrate, and 1 9 lithium citrate.
Uropherin. Theobromine, lithium, and sodium salicylate. (Diuretic.)

V.

Valerate. Valerianate.
Vallet's Pills. Pills of ferrous carbonate.
Valoid. English name for fluid extract.
Valonia. Fruit (acorn) of.
Vapor Antiloimius. Chlorine.
Vegetable Optic. Herapath's salt. Quinine iodosulphate.
Venus. Copper.
  Crystals of. Copper acetate.
Vervain's Balsam. Compound tincture of benzoin.
Vienna Powder. Potassa with lime.
Vigoral. A mixture of beef extract and powdered beef. (Armour & Co., Chicago.)
Vin Mariani. Compound wine of coca. French specialty.
Vinegar of the Four Thieves. An aromatic vinegar of the French Pharmacopœia.
Vinolia Preparations. Contain zinc oxide and borax.
Vinum Adustum. Alcohol. (Sometimes brandy.)
  Crematum. Brandy.
Virgin's Milk. A mixture of tincture of benzoin and water.
Viride Æris. Verdigris. (Crude copper acetate.)
Viscum Album. Mistletoe.
Vitriolum Cupri. Blue vitriol.

W.

Wade's Drops. Compound tincture of benzoin.
Wash Rag. Luffa ægyptiaca.
  Goulard's. Lead water.
Waterglass. Sodium or potassium silicate.
White Copperas. Sulphate of zinc.
  Flake. Lead carbonate.
  Liquor. Southern negro term for alcohol.
  "Nix." Crude zinc oxide.
  Pearl. Bismuth subnitrate or chloride.
  Permanent. Artificial barium carbonate or sulphate.
Wolfram. Tungsten.
Wolframate. Tungstate.
Wound Balsam. Compound tincture of benzoin.

Y.

Yellow Arsenic. Yellow arsenic sulphide.

Z.

Zea. Maize. Indian corn.
Zinc Flowers. Zinc oxide.
Zinchæmol. The same as hæmol.
Zootic Acid. Prussic acid.
Zooticum. As adjective to several salts. Hydrocyanate.
Zymine. English name for pure pancreatin.
Z. Z. Anciently myrrh, now zingiber. Ginger.

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